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The female menstrual cycle is inherently complex and there is great diversity in the hormonal profiles that maintain and govern the seemingly normal female reproductive cycle. Female sex hormones are linked to a breadth of physiological and psychological health mechanisms, yet timing, exposure, and flux of these hormones have been linked to both positive and negative health outcomes (Charkoudian, 2017; Dubey and Jackson, 2001; Henderson and Paganini-Hill, 1994; Karapanou & Papadimitriou, 2010; McEwen, 2017; Parazzini, 1993; Seifert-Klauss, 2010; Solomon, 2002; Terry, 2005; Yoo, 2016). Physical activity can have a large influence on menstrual function (Ackerman et al., 2020; Burch, 2000; Loucks, 1998; Mena, 2019; Redman, 2005; Reed, 2018; Sharma, 2013), and further exploration is needed to consider the balance between positive health benefits that come with exercise, and negative ones that may be associated with menstrual irregularities and infertility.

The Health and Reproductive Survey (HeRS) was designed to investigate the impacts of physical activity and sport history participation on reproductive health from menarche to current (Ackerman, in press). The purpose of this study was to (1) investigate the reliability of (test-retest) recall data regarding menstrual health (menarche to menopause), (2) explore correlations between activity level, BMI, and self-identified athlete type associated with age at menarche, (3) investigate activity profiles of women experiencing menstrual irregularities (prevalence of secondary amenorrhea in athletes vs. non), (4) investigate changes in physical activity level and menstrual cycle characteristics (i.e. frequency, duration, and intensity) and (5) explore the prevalence of women using birth control in various age ranges and by self-identified athlete type.

Within this study, 144 respondents took part in a test-retest procedure of the HeRS at timepoint one (T1) and four months later (T4mo). The average age of respondents was 32.73 +/- 11.919. The majority of participants (76.4% of respondents) reported reaching menarche at a normal age

(between the ages of 12-15). Average BMI at the age of menarche was 20.15 +/- 2.884 (n=97), with a minimum of 12.86 and a maximum of 36.56. At the time of menarche, 82.6% of respondents reported being physically active. The majority of respondents reported being physically active 5-10 hours per week (30.6%), with the next largest group reporting 11-15 hours of physical activity per week (20.1%).

The reliability of recall for menarche related questions showed no distinct difference based on the current age of the respondent, but the lack of medical records to validate the accuracy of respondents' answers suggests that while older age groups showed high recall reliability, there is no way of knowing if their answers are more or less accurate. There was no significant relation between hours of physical activity at menarche and age at menarche. Over 40% of women in each age range reported irregular cycles (> 12 cycles or <10 cycles per year), a much greater value than currently reported in the literature (1.8-5%) (Peterson et al., 1973; Singh, 1981). Physician diagnosis of disordered menstrual cycles was lower (18.1%-36.1%), but still much higher than values from existing research.

A number of HeRS questions were dropped from recall reliability testing due to poor survey design causing skewed and unreliable respondent answers (i.e., height in high school, physical activity change). It is suggested that these questions, as well as altering overlapping age ranges (i.e., 13-18; 18-24) be adjusted before the next administration of the HeRS. Finally, since the objective of the HeRS is to track female reproductive health with a focus on the influence of physical activity and sport participation, questions should be added to each age section to better clarify the number of hours of physical activity performed per week as well as the intensity level of that activity (Beals, 2002; Dusek, 2001; Freedman, 2002; Lagowska & Kapczuk, 2016; Mountjoy, 2018). The length and repetitive nature of questions within each section of the HeRS should be acknowledged, and questions that provide less crucial information should be considered for exclusion from future HeRS to reduce potential survey fatigue (Sinickas, 2007).

RECALL VALIDITY OF THE HEALTH AND REPRODUCTIVE SURVEY (HeRS) AND FINDINGS OF MENSTRUAL HEALTH OF YOUNG ACTIVE FEMALES

by

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CHAPTER I

INTRODUCTION

The onset of menstruation represents a significant transition in the female lifespan—entrance into child-bearing age. The menstrual cycle in females is inherently complex and there is great diversity in the hormonal profiles that maintain and govern the seemingly normal female reproductive cycle. Female sex hormones are linked to an expanse of physiological and psychological health mechanisms, yet timing, exposure, and flux of these hormones have been linked to both positive and negative health outcomes. Physical activity can have a large influence on menstrual function, and further exploration is needed to weigh the balance between positive health associations that come with exercise, and negative ones that may be associated with menstrual irregularities and infertility.

The female reproductive cycle refers to cyclical changes of the uterus in reaction to hormones produced by the hypothalamus, pituitary, and ovaries (Reed, 2018). While there are clinical guidelines as to what is considered a normal and healthy cycle, there is great inter-individual variation between women based on genetics, biology (body type, race), lifestyle (e.g., nutrition and exercise), and socioeconomic class (Karapanou and Papadimitrious, 2010). There is also a great amount of intra-individual variety within one's lifetime that can be attributed to reproductive events such as pregnancy, lactation, and menopause, or disorders such as secondary amenorrhea or polycystic ovary syndrome (Ackerman et al., 2020).

Female sex hormones are significant for growth and development during adolescence and for fertility during child-bearing years, but these hormones are also vital for general health across the lifespan. Sex hormones play a key role in the regulation of bone health, body temperature, cholesterol, and many organ systems (Charkoudian, 2017; Seifert-Klauss, 2010). Thus, deficiencies in these hormones impacts overall physical health and wellness, albeit the most obvious are linked to reproductive health. Early exposure to these hormones, such as observed in early menarche, has been linked to negative health consequences later in life, such as higher incident cardiovascular disease, coronary heart disease, cancer mortality and all-cause mortality

even after controlling for BMI, physical activity, smoking, alcohol, educational level, and more (Karapanou & Papadimitriou, 2010; Yoo, 2016).

Energy expenditure has proven to play a significant role in menstrual cycle irregularities that are indicative of defects in hormone production (Reed, 2018). Both high energy availability (i.e., overweight and obesity) and low energy availability (i.e., eating disorders or excessive physical activity) have been linked to menstrual disturbances, infertility, and anovulation (Loucks, 1998; Mena, 2019; Redman, 2005; Sharma, 2013). Early life energy availability significantly impacts the age of menarche, with higher subcutaneous fat levels and BMI at prepubertal ages (5-9 years) associated with early menarche (<11 years) (Freedman, 2002), while high levels of physical activity has proven to significantly delay menarche (Dusek, 2001).

Importantly, as the rate of obesity and overweight increases, concomitant with increasing numbers of exercising women and rising female sport participation, studying menstrual health is crucial (Mena, 2019; Warren, 2000). The long-term health consequences of menstrual irregularities must be clearly identified in order to establish guidelines for physical activity recommendations that optimize the health of females (Warren, 2000). Female athletes must be provided education related to training around the menstrual cycle for optimized adaptation and performance, while weighing the possible long-term health consequences (Birch, 2000; Warren, 2000).

Currently, there are very few in-depth surveys that record the life histories of reproductive health of a broad general female population. The Health and Reproductive Survey (HeRS) is a newly developed tool designed to collect reproductive histories across a large sample of females with the express goal of addressing the connectivity between physical activity and menstrual health across the lifespan.

The purpose of this thesis study will be to (1) investigate the reliability of (test-retest) recall data regarding menstrual health (menarche to menopause) questions of the Health and Reproductive Survey (HeRS), (2) explore any correlations between activity level, BMI, and self-identified athlete type associated with age at menarche, (3) investigate activity profiles of women

experiencing menstrual irregularities (prevalence of secondary amenorrhea in athletes vs. non), (4) investigate how changes in physical activity level may influence menstrual characteristics (i.e. frequency, duration, and intensity) of the menstrual cycle, (5) explore the prevalence of women using birth control at various age ranges and based on self-identified athlete type. The following hypothesis are based on previous research:

Hypothesis 1: HeRS 4-month test-retest recall reliability will be acceptable for most survey questions.

Hypothesis 2: HeRS 4-month test-retest recall reliability of the menarche section (part 1) will be high in younger females but lower in older females.

Hypothesis 3: Females that reported higher activity levels at the age of menarche will also report older ages of menarche.

Hypothesis 4: Females that self-identified as competitive athletes with higher activity levels will report fewer number of menstrual cycles per year than those that reported lower activity levels.

Hypothesis 5: A decrease in physical activity level will be correlated to an increase in frequency, duration, and intensity of menstrual cycle, and vice versa.

Hypothesis 6: Birth control use will be most prevalent in college aged women (18-24).

CHAPTER II

LITERATURE REVIEW

Overview

This literature review will discuss the normal menstrual cycle and female sex hormones, the role of physical activity in menstrual irregularities, methods for testing recall reliability, the Health and Reproductive Survey (HeRS), and limitations to the self-reported method of the HeRS.

2.1 The Menstrual Cycle and Female Sex Hormones

2.1.1 The Menstrual Cycle

The female reproductive cycle refers to cyclical changes of the uterus in reaction to hormones produced by the hypothalamus, pituitary, and ovaries (Reed, 2018). Gonadotropin releasing hormone (GnRH), the hypothalamic releasing factor, causes release of follicle stimulating hormone (FSH)—initiating growth of a dominant follicle in the ovary (Birch, 2000; Reed, 2018). FSH and luteinizing hormone (LH) prime the ovary to secrete estradiol, peaking about 24 hours before ovulation (Birch, 2000; Reed, 2018). The spike in estradiol causes a feedforward mechanism that releases more LH from the hypothalamic-pituitary axis (HPA) (Birch, 2000; Reed, 2018). Ovulation occurs at the peak surge of LH. The remaining cells of the follicle will continue to produce estradiol and progesterone, and these act via negative feedback on the axis to stop the release of FSH and LH (Birch, 2000; Reed, 2018). An illustration of a normative menstrual cycle is provided in Figure 1.

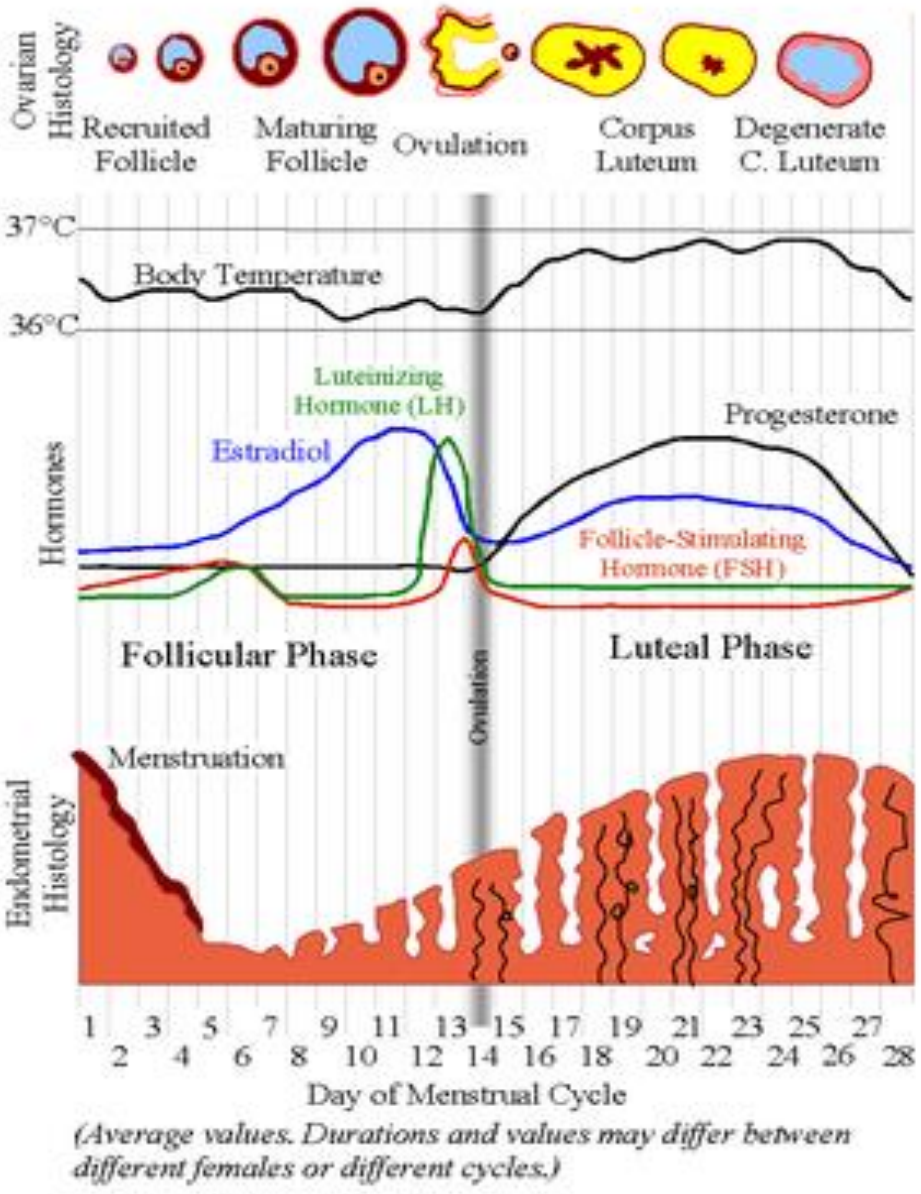

Figure 1: Hormonal, Ovarian, Endometrial, and Basal Body Temperature Changes and Relations Throughout the Normal Menstrual Cycle (Carr, 1998).

2.1.2 The Roles of Female Sex Hormones

Reproductive hormones play a key physiological role in growth and development through adolescence, fertility in adulthood, and the maintenance of various organ systems (Ackerman, in press). Increases in estradiol at the time of menarche along with progesterone produced at

ovulation both contribute to establishing peak bone mass density in young girls (Seifert-Klauss, 2010). Both hormones continue to collaborate in the remodeling of bone throughout adulthood, estradiol contributing to the resorption of bone tissue, and progesterone to the formation of new bone (Seifert-Klauss, 2010).

Estrogen and progesterone also play a role in thermoregulation, both centrally and peripherally. Estradiol's vasodilatory affects promote heat dissipation at the skin and lowers blood pressure in females (Charkoudian, 2017). Specifically, this response is accomplished by augmenting β-adrenergic receptor mediated vasodilation and offsetting α-adrenergic vasoconstriction (Charkoudian, 2017), resulting in an overall weak relation between muscle sympathetic activity and blood pressure. On the contrary, progesterone promotes heat conservation and higher body temperatures (Charkoudian, 2017).

Studies investigating the sex difference in the brain have highlighted the role of estrogen on extrahypothalamic brain function. Estradiol impacts learning and memory, excitability, neuroprotection, addiction, cardiovascular regulation, pain sensitivity, and fine motor skills, coordination, and reaction time (McEwen, 2017). Estradiol also protects neurons from excitotoxic damage during seizures, stroke, and Alzheimer's disease (Henderson and Paganini-Hill, 1994; McCullough et al., 2003).

Ovarian hormones have also shown involvement in cholesterol production, immune response, and protection of the renal and cardiovascular systems (Dubey and Jackson, 2001; Khan and Ansar Ahmed, 2015).

Proven to be significant across a spectrum of general health development, regulation, and maintenance, deficiencies in female sex hormones likely impact overall health and wellness. Insufficient exposure (measured by menstrual irregularity) is linked to increased risk for type 2 diabetes, coronary heart disease and osteoporosis (Solomon, 2001; Solomon, 2002). Yet, less exposure—categorized by longer or irregular cycles, has also been shown to have a protective effect resulting in reduced risk of breast and ovarian cancer (Parazzini, 1993; Terry, 2005). Interestingly, longer exposure to higher-level sex hormones from a young age (i.e., early

menarche) has been linked to negative health outcomes later in life including higher incidence of obesity, diabetes, cardiovascular disease, and cancer (Karapanou & Papadimitriou, 2010; Yoo, 2016). Even after controlling for age, physical activity, smoking, alcohol, educational level, occupational social class, oral contraceptive use, hormone replacement therapy, BMI and waist circumference, women who experienced early menarche were at higher risk for hypertension, cardiovascular disease, coronary heart disease, all-cause mortality, cardiovascular disease mortality, and cancer mortality (Lakshman 2009).

However, late menarche is associated with poorer bone health. Studies investigating post-menopausal women have found those who reached menarche later have lower mineral density at the forearm, spine, and proximal femur, putting them at greater risk for fractures (Fox, 1993). Women who experienced early menarche have been found to have slightly higher bone mineral density of the lumbar spine and femoral neck into old age (controlled for BMI) even when compared to women who received hormone replacement therapy (Gerdhem, 2004).

Unfortunately, categorization of females into ‘early’ or ‘late’ menarche as a proxy for duration of hormone exposure when investigating the effect of sex-steroid hormones on long-term health outcomes in women is far too simplistic. This method fails to consider many other factors implicit in hormone exposure over the lifespan since; 1) great variability occurs in the timeframe it takes for a girl to establish a regular cycle, 2) life events (such as pregnancy) and secondary amenorrhea alter a woman’s exposure to reproductive hormones, 3) anovulatory cycles or luteal phase defects reduce total hormone output compared to normal and perhaps most importantly, 4) use of hormonal contraceptives (oral or other) and infertility treatments (i.e. extensive exposure to hormones and manipulation of cycles) over the lifespan is not considered. Even cycle length, which has been suggested as a relevant indicator of estradiol exposure, has shown that women with short cycles will experience less hormonal exposure per-cycle, but cumulative exposure over time is greater (Mumford et al., 2012).

The eumenorrheic ‘normal’ cycle lasts on average 29 days, but clinical guidelines state anything between 25-30 days as normal (Bull, 2019; Reed, 2018). The average age of menarche is 12 (Karapanou and Papadimitrious, 2010), and menopause is 49 (Santoro, 2016). However, there is

significant inter-individual variation of menses events and cycling between females, as well as intra-individual variation across one's lifetime. Inter-individual variation has been studied largely in the context of age of menarche, but also menstrual regularity. Associations with menstrual regularity have been made with many factors including genetics (e.g., the Kiss 1 gene), biology (e.g., race, BMI), lifestyle (e.g., physical activity and nutrition), socioeconomical (e.g., low socioeconomic status), and even geographical (e.g., country, climate) (Karapanou & Papadimitriou, 2010). Intra-individual variation across one's lifetime can involve early menarche (before the age of 12) or late menarche (primary amenorrhea; after the age of 15), oligomenorrhea (cycles lasting longer than 35 days), anovulation (a cycle without ovulation), dysmenorrheal (pain with menstruation), heavy menstrual bleeding (more than 80mL lost; (Reed, 2018)), and luteal phase defects (smaller window of time between ovulation and period). In addition, other life events can alter the normal cycle, including pregnancy (increases in estrogen and progesterone accompany amenorrhea), and lactation amenorrhea (increased prolactin decreases release of gonadotropin releasing hormone, thus reproductive hormones) (Ackerman et al, 2020). Lastly, disorders such as polycystic ovary syndrome (PCOS), endometriosis, hyperprolactinemia, Asherman's syndrome, and various medications have the ability to impact normal menstrual rhythms. The issue of PCOS is increasingly important, since the worldwide prevalence has steadily increased and the definition and etiology are poorly described (Barthelmess & Naz 2014). These disturbances indicate that defects somewhere along the hypothalamic-pituitary-ovarian-uterine axis (Reed, 2018) are responsible for dysfunction.

2.2 Physical Activity and Menstrual function

Looking closer at the association between physical activity and the female sex hormones (i.e., estrogen and progesterone), it becomes evident that the relationship is bidirectional (Ackerman et al. 2020). Not only do estrogen and progesterone impact the growth, development, and regulation of imperative organ systems required to perform and succeed in physical activity, but further associations have been found between menstrual phase and physical performance, as well as physical activity effects on estrogen and progesterone availability (Burch, 2000). These findings suggest a series of highly integrated feedback/feedforward loops that systematically assimilate physical activity and performance with the menstrual cycle and sex-steroid hormones.

Investigations addressing the impact of menstrual cycle phase on physical performance measures have produced significant variability in findings—at least partly due to inconsistent utilization of standardized methodology, incomplete or poor reporting of methods, or some combination of these issues. In addition, failure to clarify definitions and distinctions between physical activity, performance and exercise further obfuscate the literature. Herein, this document defines physical activity as any bodily movement that requires energy expenditure (Caspersen et al, 1985). Exercise is a subcategory of physical activity that is planned, structured, repetitive and purposeful and is intended to improve or maintain fitness (Caspersen et al, 1985). Fitness is the state of being fit (Caspersen et al, 1985) for the ability to perform sports, occupations, or daily activities, while athletic performance describes the efforts made by an athlete to attain specific performance objectives over a period of time (Ackerman et al, 2020). Since the HeRS is intended to serve the broad population of women, and assess menstrual function across the entire life course, the questionnaire investigates physical activity participation as well as competitive athletic or sport participation.

2.2.1 Performance and the Menstrual Cycle

A few older studies report variations in performance based on menstrual cycle phase, including decreases in performance during menses of 50 m swimmers (Bale and Nelson, 1985), increased handgrip strength during menses with no effect on standing broad jump (Davies et al. 1991) and no difference in handgrip strength across menstrual phases (Higgs and Robertson 1981). Later studies implied a positive relationship between estrogen peak in the late follicular phase and strength (maximum voluntary force) (Phillips et al., 1996), however the determination of phase in these studies is questionable. De Jonge (2001) found no effect of menstrual phase on quadricep and hamstring strength and fatiguability or handgrip strength.

At rest, estrogen levels have significant effects on metabolism through various mechanisms (Bunt, 1990). And, since acute bouts of exercise increase concentrations of estrogen and progesterone due to changes in hepatic clearance rates or increased secretion (Bonen et al., 1991), it seems likely that increased estrogen concentrations will have some metabolic effect during exercise. Estrogen has significant effects on metabolism that imply a glycogen-sparing effect and shift towards lipid metabolism (Birch, 2000). Bunt (1990) reported that higher levels

of estrogen have; 1) correlated with higher insulin levels and decreased glucagon levels, resulting in an inhibition of gluconeogenesis and glycogenolysis, 2) increased synthesis of triglycerides and high-density lipoproteins, 3) increased lipolysis in muscle and adipose and 4) increased production of catecholamines, causing increases in growth hormone and cortisol throughout the system. Both growth hormone and cortisol have a contra-insulin effect, leading to a decrease in peripheral glucose up-take and utilization (Bunt, 1990). Thus, it would seem that when estrogen concentrations are highest during the luteal phase of the menstrual cycle, glycogen-sparing would enhance performance in the context of exercise to exhaustion (Bunt, 1990). A study of six eumenorrheic females reported exercise time to exhaustion was greater during the midluteal phase, as well as glycogen repletion following a depletion exercise bout, while glycogen utilization during the time to exhaustion exercise did not differ (Nicklas et al. 1989). This implies an increased concentration of free fatty acids, which enhance performance (Birch, 2000). However, Gordon (2018) found no significant effect of menstrual cycle phase on maximal oxygen uptake (VO2 max). While results vary, it remains unclear whether the fluctuations of female sex hormone concentrations throughout the menstrual cycle significantly influence athletic performance.

2.2.2 The Influence of Physical Activity on Energy Balance and the Menstrual Cycle

More evident is the effect of physical activity on female hormone flux, specifically the impact of energy expenditure and overall energy balance, on menstrual dysfunction. Energy expenditure has proven to be significant in the role of menstrual cycle irregularities indicative of a defect in hormone production (Reed, 2018). Energy availability (EA), both high (i.e., overweight and obesity) and low (i.e., eating disorders or physical activity), have been linked to menstrual disturbances, infertility, and anovulation (Loucks, 1998; Mena, 2019; Redman, 2005; Sharma, 2013). High energy availability through a greater caloric consumption than energy expenditure (physical activity) is widely known to associate with menstrual irregularities (Mena, 2019; Talmor, 2015). Obesity is a major etiology for menstrual irregularities and infertility, driven by an increase in free androgens and concurrent insulin resistance, causing disruption in the hypothalamic-pituitary-ovarian axis, oocyte quality, and endometrial receptivity (Sharma, 2013; Talmor, 2015). Increased adiposity causes an increase in peripheral aromatization of androgens to estrogens and decrease in hepatic synthesis of sex hormone-binding globulin (SHBG)

(Talmor, 2015). This is intensified by hyperinsulinemia which decreases SHBG further and increases androgen production by the ovaries (Talmor, 2015). The result is an over-secretion of LH, and increased estrogen to androgen ratio, which leads to folliculogenesis and anovulation (Talmor, 2015).

Decreasing the high energy availability through weight loss from physical activity treatment or surgical approaches restores menstrual regularity, signifying energy availability has a key connection to the HPO axis. Physical activity has proven as effective as fertility treatment or treatment for PCOS in improving pregnancy rates, conception rates, ovulation rates, and menstrual regularity (Mena, 2019). Bariatric surgery also restores regular menstruation in >70% of anovulatory obese women (Teitelman, 2006).

Low energy availability, defined as the dietary energy left over after exercise that is available for physiological functions such as growth, muscle recovery, and homeostasis (Mountjoy, 2018), is just as tied to menstrual irregularities and infertility. Here, female athletes often experience delayed menarche and increased prevalence of secondary amenorrhea (Dusek, 2001). High-intensity training before menarche has been shown to postpone its onset (Dusek, 2001). In a study of 425 collegiate athlete across 15 sports at seven US universities, Beals (2002) found 7.4% had experienced primary amenorrhea (had not menstruated by age 16), and this prevalence increased to 22.2% within the aesthetic sports (i.e. cheerleading, diving, and gymnastics), while the prevalence of primary amenorrhea in the general population is <1% (Chumlea, 2003). While genetics have proven to relate mothers and daughters to age at menarche, this correlation is less pronounced in the athlete (Warren, 2000). Energy availability in younger years shows significance regarding the age of menarche, with higher subcutaneous fat levels and BMI at prepubertal ages (5-9 years) associated with early menarche (<11 years) (Freedman, 2002) and low energy availability associated with later menarche (Lagowska & Kapczuk, 2016).

Oligomenorrhea, luteal phase defects, anovulation, and amenorrhea in athletes are also very common (Redman, 2005). In a study of 72 female athletes, the overall prevalence of secondary amenorrhea across multiple sports was three times higher in athletes than in the control group and it was 65% in long-distance runners training 18 hours/week (Dusek, 2001). Reports of

menstrual irregularities in athletes have been as high as 78% (61% oligomenorrheic and 17% amenorrhoeic) in rhythmic gymnasts ~1 year after menarche (Klentrou, 2003), although these findings should be viewed with caution given the proximity of the assessment to menarche. In a study of 52 endurance athletes (1500 m to marathon), Burrows (2003) found 23% were oligo/amenorrhoeic (only one participant was amenorrhoeic). In another study (Rosetta, 1998) of 36 endurance runners, there was a 40% incidence of long and short cycles; the amenorrhoeic and oligomenorrheic runners logged more miles than the eumenorrheic athletes, and expressed lower body weights, younger ages, and significantly lower BMIs. The prevalence of oligomenorrhea or secondary amenorrhea of the general population of college students is around 10.6%, with secondary amenorrhea accounting for 2-5% (Singh, 1981). Table 1 shows prevalence vales for oligo- and amenorrhea in different athletic populations.

Table 1. Surveys of the Prevalence of Amenorrhea and Oligomenorrhea in Different Athletic Disciplines.

Activity	Study	n	Percentage with irregularities
General population:			
	Peterson et al (1973)	1862	1.8
	Singh (1981)	900	5.0
Weight bearing Sports:			
Ballet	Abraham et al (1982)	29	79.0
	Brooks-Gunn et al (1987)	53	59.0
	Feicht et al (1978)	128	6-43
	Glass et al (1987)	67	34.0
Running	Shangold and Levine	394	24.0
	(1982)	237	26.0
	Sanborn et al (1982)		
Non-weight bearing sports:			
Cycling			
Swimming	Sanborn et al (1982)		12.0
	Sanborn et al (1982)		12.0

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The pathophysiology of the amenorrhoeic athlete is complex, involving prepubertal training, training load and intensity, regulated diets, and psychological stress (Redman, 2005; Warren, 2000). While restricted diet and high training loads may cause decreased metabolic rate, the

adaptations that lead to menstrual dysfunction are not fully elucidated (Warren, 2000). Early theories suggested a threshold of body fat, 22%, was necessary to produce a regular menstrual cycle (Warren, 2000). This was suggested since leptin, which is secreted by adipocytes and shown to be directly proportional to body fat mass, influences the GnRH pulse generator whereby abnormal levels may impair regular menstrual cycle generation (Kopp, 1997). However, more fine-grained investigations have shown that many athletes above this 22% body fat threshold still show menstrual cycle related irregularities, and normal cycles have been seen in athletes with body fat percentages below 17% (Loucks, 1985).

Another theory established from animal studies implied physical activity activates the hypothalamic-pituitary-adrenal axis, causing a stress-response release of corticotrophin releasing factor (CRF) that suppresses the GnRH pulse generator (Warren, 2000). This would coincide with other stress-response hormone increases documented in amenorrheic athletes such as cortisol rhythms and adrenocorticotropic hormone (ACTH) (Warren, 2000).

The most established theory lies in low energy availability causing a decrease in gonadotropin-releasing hormone (GnRH) pulses from the hypothalamus, causing a decrease in pulsatile secretion of LH and FSH, turning off stimulation of the ovaries, and resultant decreases in estradiol and progesterone (Mountjoy, 2018; Redman, 2005; Warren, 2000). This connection between energy availability and amenorrhea is far more common in sports encouraged to have a low body weight (i.e. gymnastics, endurance running, dancing) (Dusek, 2001). In a meta-analysis of 28 studies, Redman (2005) found exercise had no disruptive effect on LH pulsatility beyond the impact on energy availability, which could be prevented with supplementation to the diet equal to exercise energy expenditure.

Low energy availability and carbohydrate intake has been linked to higher testosterone levels in female athletes and ballerinas, suggesting a potential protective mechanism of testosterone against weight loss by building lean tissue mass (Miller et al., 2016), and indicating another potential mechanism of disruption of the HPO axis (Lagowska & Kapczuk, 2016). These athletes, however classified as experiencing hyperandrogenism, did not present hirsutism, acne, alopecia or voice deepening (Lagowska & Kapczuk, 2016). This type of menstrual irregularity

profile signified by hyperandrogenism shows higher androgen levels as well as elevated LH, increased LH:FSH ratio, and regular estrogen levels (Warren, 2000). While Lagoska & Kapczuk found this hyperandrogenism within the most severe low energy availability and menstrual dysfunction athletes, Sanborn (1982) indicates this profile was associated to sports where low body weight is not required (such as swimming), in which irregular/longer cycles (not complete amenorrhea) are more common.

Concern over menstrual dysfunction in athletes arises with short term bone deficiencies, and long-term infertility. Athletes with shortened luteal phases, oligomenorrhoea, and anovulation often experience infertility (Redman, 2005), but this may be reversible with a halt in exercise and weight gain (Warren, 2000). Greater immediate concern involves amenorrhoeic athletes' reduced bone mineral density (Otis, 1997) and increased frequency of stress fractures (Bennell, 1997). Originally believed to be due to chronic hypoestrogenism failing to inhibit the resorption of bone, bone densities of amenorrhoeic athletes are not restored with hormone replacement (Cummings, 1996) or oral contraceptive therapy (Rickenlund, 2004). Instead, these impairments in bone density may be due to other metabolic hormones reduced in amenorrhoeic athletes such as insulin, or insulin-like growth factor I (IGF-I) (Zanker, 1998).

2.2.3 Female Athlete Triad (FAT) and Relative Energy Deficiency in Sport (RED-S)

Research related to the influence of energy availability on hormone pulsatility in athletes has increased in recent years within two separate camps of research; the first called the Female Athlete Triad (FAT) and the other Relative Energy Deficiency in Sport (RED-S). FAT—specific to female athletes, established the connection between the causality of low energy availability leading to the distinct symptoms of menstrual irregularity, with the key morbidity outcome being low bone mineral density (Stand, 2007). RED-S has expanded on this platform, inclusive of male athletes, but also highlighting the broader long-term impacts of chronic energy deficiency on metabolic rate, bone health, immunity, protein synthesis, cardiovascular health, and menstrual function (Ackerman, 2020).

Diagnostic factors of RED-S are broad and include; chronic dietary restriction and/or extreme diets, drive for thinness, large changes in body weight or composition in short time periods,

training inconsistencies, prolonged fatigue, decreased libido, oligo-amenorrhoea (missing three or more menstrual cycles in 6 months), two or more career bone stress injuries and low bone mineral density for age (Ackerman, 2020, p.). Athletes categorized as having low EA have increased health risks of menstrual dysfunction, poor bone health, metabolic issues, haematological detriments, psychological disorders, cardiovascular impairments, and gastrointestinal dysfunction (Ackerman, 2019). Performance decrements of low EA extend beyond limiting training adaptations and include impaired judgement, decreased coordination, decreased concentration, irritability, depression, and decreased endurance performance (Ackerman, 2019), as well as decreased testosterone, which is particularly significant for male athletes (Mountjoy, 2018).

Ultimately, low energy availability described by exercise cost outweighing dietary energy remaining for normal physiological functions has been found to decrease training adaptation and increase risk of short and long-term health consequences. While menstrual irregularities are a key pillar within the FAT ideology, they remain significant indicators of low energy availability within the RED-S construct.

As rates of obesity and overweight individuals increase, as well as the number of exercising women and female sport participation, studying menstrual health is crucial (Mena, 2019; Warren, 2000). The long-term health consequences of menstrual irregularities (and low EA) must be clearly identified in order to establish guidelines for physical activity recommendations for optimal health (Warren, 2000). Female athletes must be further educated on how to train around their menstrual cycle for optimized adaptation and performance, while weighing the possible health consequences long term (Ackerman, 2020; Birch, 2000; Warren, 2000).

2.2.4 Usage of Oral Contraceptives in the Athletic Population

There is no literature to our knowledge as to why athletes may be taking oral contraceptives. Many amenorrhoeic athletes are prescribed oral contraceptives as hormone therapy by physicians aligned with the common misconception that a supplementation of estrogen and progesterone will prevent bone mineral loss and reduce risk of bone injury. While Rickenlund (2004) and Cummings (1996) have disproved these methods for bone preservation in amenorrhoeic athletes,

the practice is still quite common. We also predict female athletes likely to use oral contraceptives to manipulate their menstrual cycle either to assuage symptoms of dysmenorrhea or around times of competition due to beliefs that it hinders performance.

While we may not know the underlying reasons as to why athletes are taking oral contraceptives, there are a few studies that provide figures of prevalence within athletic populations. Beals (2002) found that oral contraceptive use was reported in 26.7% of the 425 collegiate athletes surveyed. Agel (2006) found 32.5% of the 3,150 NCAA college athletes surveyed were taking some form of hormonal therapy. Paulus (2000) observed within the general adolescent population aged 12-17 (not specifically athletes), that 14% of the 784 Belgian students surveyed were taking oral contraceptives, two-thirds of which were low-dose pills of gestodene or desogestrel.

Wojtys et al (1998) found that 20 of the 28 (71.4%) female recreational or competitive athletes (age 23 +/- 11 years; with previous ACL injuries) surveyed believed that their individual athletic performance was hindered during their menstrual cycle. This correlated to reported experiences of premenstrual symptoms. This was inversely related to oral contraceptive use, which was reported by 5 of the 28 (17.9%), who reported to have little or no premenstrual syndromes and their menstrual cycle having no impact on athletic performance. This supports what our hypothesis that many female athletes (especially more competitive ones) are likely to report using oral contraceptives to manipulate their menstrual cycle due to athletic participation.

2.3 Methods for Testing Recall Reliability

The gold standard method for validity of recall data in medical environments involves comparing interview responses with independent records (i.e. official hospital or medical documents) (Dex, 1995). Unfortunately, this is not feasible for menstrual cycles, since medical records are not kept every time a woman menstruates, and thus, a test-retest methodology will be used.

In the test-retest procedure, a repeat interview is carried out where participants are asked the exact same questions spanned across a certain time period (Dex, 1995). Response consistency is

then compared, examining gross and net difference rates between the responses of the two interviews (Foreman and Schreiner, 1991). Consistency between the structure and presentation of both interviews is important, since order and grouping of questions can influence responses and recall (Loftus et al., 1990).

Regarding the accuracy of recall data, the retention of accurate memory relies largely on the subject matter being recalled (Dex, 1995). The more salient an event, the less error in recall, and the elapse of time is rather insignificant (Cannell and Henson, 1974; Mathiowetz and Duncan, 1998). Personal events often follow a retention pattern of a hyperbolic or power function; recent memories are most accurate to recall, but then these decay in a stable manner over a long time (Rubin and Baddeley, 1989). While neutral events are known to have the worst recall capacity (Thompson, 1985), some studies have found pleasant events are recalled with more accuracy than unpleasant events (Skowronski, 1991), while others say they are recalled to the same extent (Thompson, 1985).

In regard to menstrual cycles, it is likely the saliency and (un)pleasantness of the event is dependent upon the individual. However, given a girl's first menstrual cycle is often a relatively shocking if not traumatic experience, it can be presumed that recall regarding the age of menarche should be fairly accurate. Other extenuating factors may also play a factor in recall, such as menstrual discomfort and pregnancy events. While it may be impossible for women to remember every time they experienced a menstrual cycle throughout their lifetime, it seems likely they would be able to recognize patterns of regularity or irregularity surrounding pertinent life events.

In a review of studies regarding the retrospective recall error of the age of menarche against medical records, Holt et al. (1991) found a positive relation between magnitude of error and length of recall. When the recall was around four years, most errors (63%) were less than three months away from the real value, with a correlation between true and reported age to be 0.81 (Bergsten-Brucefors, 1976). When recall was 39 years, only half (50%) of the errors were less than six months, and the correlation had decreased to 0.61 (Damon and Bajema, 1974). These results suggest reporting errors for the age at menarche is normally distributed symmetrically

around the true value, but Holt et al. also explicitly states "errors in recall of timing of events. . . may lead to very misleading estimates of duration distributions" (Holt et al., 1991, p. 2). Put into the context of this study, however, we are expecting a larger sample size across multiple ages to level out some of these errors.

Other studies investigating recall reliability have found women to have greater accuracy in recalling certain life events. In a study of test-retest recall reliability regarding mammogram screening, Barratt (2000) found high validity with about a quarter (24.4%) of women recalling the exact date of their last mammogram and another third (39.4%) correctly reporting the month of their last mammogram. Almost all women (91.3%) reported the mammogram date accurately to within 12 months of that recorded within medical records (Barratt, 2000). Cherlin and McCarthy (1984) found women to be more accurate than men at recall of marital and fertility histories.

Recall of physical activity has been studied widely, proving test-retest reliability as well as long-term recall reliability valid (Blair, 1991; Brown, 2004; Falkner, 1999). Brown (2004) tested four self-reporting physical activity questionnaires, finding them valid for assessing activity level and sedentariness, and even a moderate reliability for total minutes of activity. Blair (1991) analyzed long-term recall reliability of physical activity against a baseline measurement 1-10 years after examination, finding a 60-75% agreement in recall. In this study, length of recall interval was not a contributing factor to error and recall of vigorous activity proved more accurate than less intense activity (Blair, 1991). Falkner (1999) tested long-term recall reliability of physical activity over 30 years and found large correlations including higher recall for females in more categories. Overall, research has shown test-retest reliability and long-term recall reliability to be high regarding women's health histories and physical activity.

2.4 The Health and Reproductive Survey (HeRS)

The HeRS was designed to investigate the impacts of physical activity and sport history participation on reproductive health from menarche to current (Ackerman, in press). The survey was developed by a collaboration of experts in women's health, sports endocrinology, sport and

exercise science, and survey measurement methods (Ackerman, in press). It is divided into sections based on age starting with (1) menarche/first period and ending with (5) current status/ ≥ 40 years.

The first section of the survey regarding menarche gives primary focus to the age of first menstruation, physical activity level at the time, and familial (maternal and female siblings') reproductive health. The following four sections contain the same repeating 138 questions in reference to the corresponding age range. The primary focus is on the regularity of the menstrual cycle, attributes surrounding this regularity within the age range (i.e., height and weight) and certain life events of lifestyle changes (i.e., changes in activity level, health diagnoses, pregnancy) that may have altered the menstrual cycle frequency, duration, or flow.

The survey is 683 questions in total, although questions or entire sections may be skipped depending on the participant's age and health history (Ackerman, in press). The survey takes 12-15 minutes for native English speakers with at least a third-grade literacy level (Ackerman, in press). The survey was validated for face validity and content validity (Ackerman, in press).

2.5 Limitations of the HeRS Due to Methods of Self-Report

Since the HeRS is a self-reported questionnaire, there are limitations to the results and conclusions to be interpreted from this data. While the elapse of time shows to make little difference to the recall of salient events (Cannell and Henson, 1974) such as we would believe of menarche, it is expected that broader questions regarding the number of menstrual cycles per year and max/min height and weight will portray less reliability, especially within the older population recalling their youngest years. These questions not only ask for specific identifying metrics but ask for these values averaged or summated over a spanning period of time.

Even if strong recall reliability is confirmed in this study, it is impossible to explain the accuracy of the data reported without the potential for comparison with independent records (Dex, 1995). This survey also maintains that respondents are honest about sensitive personal information such as eating disorders, pregnancy and abortion, and oral contraceptive use. The sensitivity and

vulnerability that comes with some of these questions may provoke respondents to answer less truthfully or not divulge the extent of these events.

The HeRS also asks respondents to self-identify as a recreational or competitive athlete upon distinct age frames, as well as report specific information on physical activity participation. It is well documented that social desirability bias can lead to over-reporting of physical activity (Warnecke et al, 1997). However, total and vigorous physical activity scores tend to have higher reliabilities (Sallis, 2000), which may more greatly support data regarding competitive athletes or highly active recreational athletes which we predict to be more likely amenorrheic.

Finally, the HeRS has only so many control variables surrounding the connectivity between menstrual cycle regularity and physical activity participation. While questions regarding BMI and eating disorders provide some insight into other explanatory factors for menstrual irregularities, there are no questions regarding demographics, income, dietary practices (vegetarianism, veganism, paleo, etc.) which have shown to impact menarche (Karapanou & Papadimitriou, 2010), thus have the potential to play a role in lifelong menstrual cycle patterns. Assumptions and conclusions collected from this data must be approached with caution, and further investigation should be done to alleviate these limitations.

CHAPTER III

METHODS

3.1 Experimental Design

This study uses a retrospective self-reported online survey in a test-retest design across a 4-month time span to investigate recall validity of the HeRS. Survey data from this bout of collection as well as future administrations will be analyzed for associations regarding menstrual health.

3.2 Subject Characteristics

The survey can be completed by all women at or above the age of 18. The questionnaire is designed to be completed within 12-15 minutes for native English speakers with at least a third-grade literacy rate.

3.3 Testing Procedures

The HeRS was first opened for purposes of this study at Timepoint 1 on August 9th, 2020. Recruitment emails with a link to the HeRS was sent to a convenience sample of groups, organizations, and individual contacts believed to have broad access to women (i.e., coaches, athletes, medical students, business students, etc.). Within the recruitment email was a request to forward the survey on to any other women that may be inclined to participate. Reminders were administered 1 week later to all those who opened the link but did not entirely complete the survey. The survey was closed on September 1st, 2020.

The survey was opened again for Timepoint 2 on December 1st, 2020, and emails were sent out to all those who participated in the previous round. Those who did not fill out the survey

immediately were sent reminder emails one week, two weeks, and three weeks following. The survey was closed on January 1st, 2021.

3.4 Statistical Analysis

All descriptive data analyzed in the study was presented as mean ± SD. The statistics for each of the hypothesis of this study is described individually, below. A priori statistical significance is set at $p<0.05$.

To answer the first aim of this study, we excluded HeRS questions from analysis if: 1) they did not provide valuable information about reproductive health recall for the current thesis, 2) questions were added prior to the second survey administration (T4mo), 3) showed poor survey design leading to unreliable respondent answers or 4) did not have enough responses to give meaning to the recall statistics. All remaining survey questions within the first four sections (first menarche (M), 13-18 (HS), 18-24 (C), and 25-40 (PC)) were compared between Timepoint 1 (T1) and Timepoint 2 (T4mo) to determine the test-retest recall validity. Depending on the question type, it was run as limits of agreement (LOA) or Cohen's kappa coefficient. Limits of agreement was used on all questions of value (i.e. height, weight, questions with number ranges) to determine how closely responses agreed between T1 and T4mo. Cohen's kappa was used on all yes/no and categorical questions, and took into account the probability of respondents answering the same way at each Timepoint by chance.

Cohen's kappa agreement analysis was done assessed using to the following cut points: 0 = agreement equivalent to chance; 0.1 – 0.20 = slight agreement; 0.21 – 0.40 = fair agreement; 0.41 – 0.60 = moderate agreement; 0.61 – 0.80 = substantial agreement; 0.81 – 0.99 = near perfect agreement; 1 = perfect agreement.

The second research question followed the same procedures as the previous but only after grouping by respondents' current age into four ranges; 18-24, 25-29, 30-34, 35+. Limits of

agreement and Cohen's kappas was calculated on each question of the first section of the HeRS regarding menarche (M).

For the third objective regarding the correlation of physical activity level and BMI with age at menarche, correlation statistics examined the relationship between question 1.1 ("How old were you the first time you had your period") to question 1.15 ("Around the time of your first period, how many hours per week were you physically active, on average?"). Questions regarding the respondents' height and weight at the time of their first menstrual cycle were used to calculate BMI.

The fourth research question regarding physical activity level and menstrual irregularities took into account both the average annual number of menstrual cycles respondents had ("Between the ages of '' and '', approximately how many periods did you have per year, on average?") as well as whether the respondents were ever formally diagnosed with a menstrual disorder (amenorrhea, oligomenorrhea, female athlete triad (FAT), or relative energy deficiency in sport (RED-S)). Respondents were bucketed into groups based on whether they identified as competitive athlete, recreational athletes, or non-athletes. Within these groups, they were analyzed based on menstrual cycle number and physical activity hours, as well as the frequency of menstrual disorder diagnosis.

The fifth objective explored the relationship between a change in physical activity level and menstrual cycle characteristics. We analyzed the questions regarding how changes in physical activity ("Between the ages of '' and '', how did your menstrual cycle change when you INCREASED/DECREASED your physical activity?") and calculated the frequency of responses regarding menstrual cycle characteristic changes based on intensity, duration, and frequency ("I bled less, I bled more, I bled fewer days", etc.,) to determine general association trends.

For the sixth, and final, research question regarding the prevalence of birth control use, we analyzed the frequency of birth control use across survey section age ranges (M, HS, C, PC) and then analyzed these frequencies grouped by self-identified athlete type (competitive athlete, recreational athlete, non-athlete).

No testing for statistically significant differences was completed for any of the aims. Purely descriptive comparisons of test-retest reliability were made for all aims in this study.

CHAPTER IV

RESULTS

4.1 Subject Characteristics

In total, 144 respondents fully completed the Health and Reproductive Survey at both timepoints (the initial survey (T1) and 4months later (T4mo)). The average age of the respondents was 32.73 +/- 11.919 (See Figure 2 for frequency histogram).

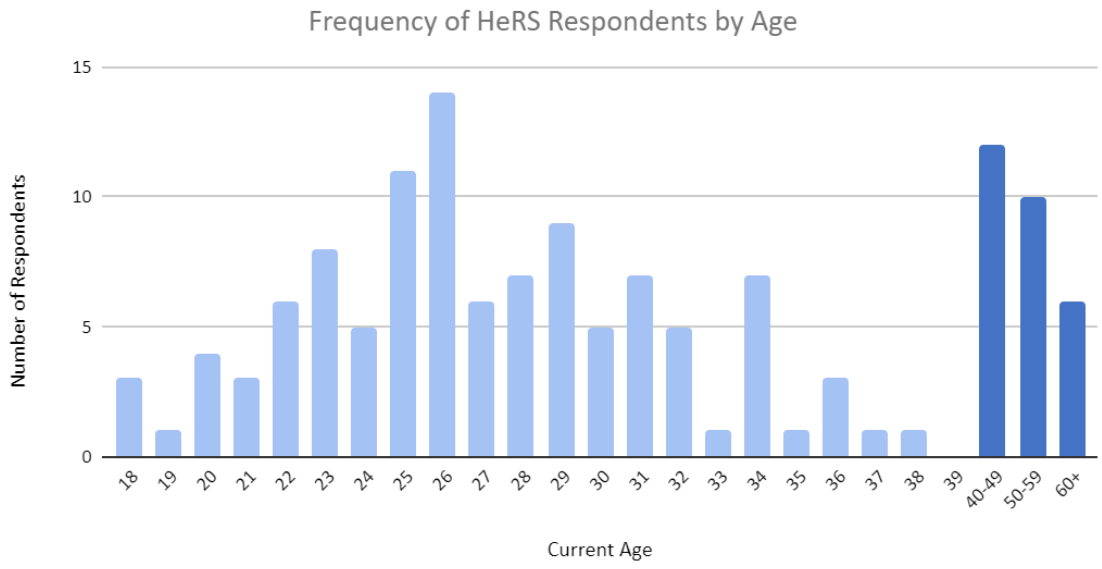

Figure 2. Frequency of HeRS Respondents by Current Age (Reported at T4mo)

The majority of participants (76.4% of respondents) reported reaching menarche at a normal age (between the ages of 12-15; only categorical variables given as choice), with their first menstrual cycle lasting 2-7 days (72.2% of respondents), getting their next menstrual cycle within six months (81.9% of respondents), and having their menstrual cycle occur on a regular basis (every 21 to 35 days) after their second menstrual cycle (63.2% of respondents).

Average BMI at the age of menarche was 20.15 +/- 2.884 (n=97), with a minimum of 12.86 and a maximum of 36.56. A total of 58.3% of respondents reported at least one biological sister. Of these sisters, 114 had some level of data reported by the respondent. Respondents reported that they knew the age range of menarche for 84.2% of their sisters. Only 29.9% of respondents reported an exact age for when their mothers reached menarche.

At the time of menarche, 82.6% of respondents reported being physically active. The majority of respondents reported being physically active 5-10 hours per week (30.6%), with the next largest group reporting 11-15 hours of physical activity per week (20.1%). When reporting the hours of physical activity performed on average at the time of menarche by value instead of categorically (T4mo; this question was altered in second recall to provide some clarity on baseline responses), the average was 8.45 +/- 6.05 hours. At the time of menarche, 41.9% of respondents self-identified as competitive athletes, 24.3% as recreational athlete, and 34% as non-athletes. The number of self-identified competitive athletes increased in the high school age section of the survey (13-18 years) to 54.2%, and progressively decreased into post-college age with only 6.3% (n=x out of a total of 114 respondents for this age group) of respondents self-identifying as competitive athletes.

Related to birth control use, 86.1% of respondents reported having ever used a form of birth control (excluding condom use), with a majority of these (62.9% of respondents) reporting to have experienced some sort of side effects with the use of birth control. The primary form of birth control used within every age range was oral contraceptives.

Extensive demographics and other descriptive data can be found in Appendix B.

4.2 Recall Reliability

4.2.1 Excluded Questions from Recall Reliability Testing

HeRS questions were dropped from recall reliability testing if they did not provide significant insight into the recall of reproductive events (i.e., "How many biological sisters do you have?") or reflected survey design issues that skewed reliability of respondents' answers.

Appendix C shows the complete list of dropped questions and variables from recall reliability analysis, as well as the reasoning behind doing so.

4.2.2. Survey Recall Reliability

Questions regarding side effects experienced from birth control, increases/decreases in physical activity level causing a change in menstrual cycle characteristics, menstrual cycle symptoms that caused one to miss a training or sports competition, reported diagnosis of medical conditions, and types of birth control used were each organized into categorical variables and analysis tested whether respondents checked the same value range of boxes per question for each T1 and T4mo.

Cohen's Kappas (Kappas) were run on all categorical survey questions, while Limits of Agreement (LOA) calculations were run for survey questions with a linear scale. The limits of agreement analysis provide insight into the absolute error for each question between T1 and T4mo.

Tables 2-5 show the Kappas and LOAs of recall reliability for each section of the HeRS (menarche (M); high school age years (HS), 13-18; college age years (C), 18-24; and post-college years (PC), 25-40). Chi square charts for each question can be found in Appendix D.

Recall of age at menarche showed significant agreement in responses between survey timepoints (Kappa=0.832; Near perfect agreement). LOA values for height and weight both reveal poor recall (Height: 0.455 +/- 6.331, mean difference in min height reported; min_{diffht}=-7.6 cms, mean difference in max height reported; max_{diffht}=20.32 cms; Weight: 0.6146 +/- 8.232, min_{diffwt}=-

15.88 kgs, max_{diffwt}=22.68 kgs), with large standard deviations and huge variations in the minimum and maximum reported across the recall timeframe. Recall of the length of respondents' menstrual cycle, time before the second menstrual cycle, and whether their cycle became regular post-second menstrual cycle all showed moderate or fair-moderate agreement (see Table 2).

Recall of physical activity (PA) status (very physically active, somewhat physically active, or not physically active) showed near perfect agreement (kappa=0.9), while recall of hours of physical activity per week had only fair agreement (0.323). Recall of ever experiencing side effects with birth control was near perfect (0.845), while the categorized variable used to count for the number of selected side effects by the respondents was substantial (0.711).

Recall of high weight, low weight, and height by respondents became more reliable at the older age ranges of the survey (PC: high weight: LOA=0.1325 +/- 5.4425; low weight: LOA=-0.158 +/- 6.1816; height: LOA=0.1768 +/- 3.00488), however the minimum and maximum values still showed high variability in responses (PC: high weight: -12.7 kgs, 7.71 kgs; low weight: -9.07 kgs, 17.69 kgs; height: -8.89 cms, 6.35 cms).

Recall of average number of menstrual cycles per year remained relatively stable between survey sections (HS: 0.551, Moderate agreement; C: 0.559, Moderate-substantial agreement; PC: 0.527, Moderate agreement). Recall of whether one's period stopped increased with age but was significant across age ranges of the survey sections (HS: 0.605, Moderate-substantial agreement; C: 0.808, Near perfect agreement; PC: 0.873, Near perfect agreement), while the longest length of time one's period stopped showed highly variable responses (HS: 1.4545 +/- 13.1410; C: -0.2632 +/- 24.7132; PC: 0.5652 +/- 9.7790).

Regarding the impact of physical activity level on menstrual cycle characteristics (i.e. intensity, duration, and flow), recall reliability kappa values of the yes/no answer to whether PA impacted cycle changes revealed moderate-substantial agreement across survey sections (PA increase, PA decrease; HS: Substantial, Moderate; C: Moderate, Moderate; PC: Substantial, Moderate), while the categorical variables which described the number of cycle characteristics impacted by

changes in PA revealed (PA increase, PA decrease; HS: Substantial; C: Moderate; Moderate, Moderate; PC: Substantial, Moderate).

Recall reliability of being diagnosed with a medical condition (menstrual cycle disorder, eating disorder, etc.) revealed substantial agreement throughout survey section age ranges (HS: 0.577, Substantial agreement; C: 0.636, Substantial agreement; PC: 0.622, Moderate-Substantial agreement).

Lastly, the use of birth control (yes/no) and the form of birth control used (categorical variable) both revealed high agreement between recall timepoints (yes/no: HS: 0.90, Near perfect; C: 0.81, Substantial-Near perfect; PC: 0.762, Substantial | categorical variable: HS: 0.803, Substantial-Near perfect; C: 0.749, Substantial; PC: 0.62, Moderate-Substantial).

Table 2. Cohen's Kappas and Limits of Agreement for the HeRS section M, Characteristics of Menarche.

Coded variable Survey Question	Cohen's Kappa Value	Kappa Agreement	LOA N	LOA mean	LOA std	LOA std (95% conf interval)
First_period How old were you the first time you had your period?	0.832	Near perfect				
weight Approximately how much did you weigh the first time you had your period? Please report in pounds (exclude units). If you do not remember, please write I cannot remember. CONVERTED TO KGs	0.093	Agreement equivalent to change	114	0.6146	4.2	8.232
height Approximately how tall were you the first time you had your period? Please report in inches	0.156	Slight	114	0.455	3.23	6.3308

(exclude units). If you do not remember, please write I cannot remember. CONVERTED TO CMs						
first_period How many days did your first period last for?	0.554	Moderate				
second_period After your first period stopped, when did you get your next period?	0.41	Fair-Moderate				
regularity After your second period, did your periods start to occur on a regular cycle (every 21 to 35 days)? YES/NO/IDK	0.566	Moderate				
mom_period How old was your mother when she got her first period? If you do not know, please write I do not know.	0.689	Substantial	43	0.0465	0.6057	1.1871
Sister 1 How old was your sister when she got her first period? If you do not know, please write I do not know.	0.72	Substantial				
Sister 2 How old was your sister when she got her first period? If you do not know, please write I do not know.	0.351	Fair				
Sister 3 How old was your sister when she got her first period? If you do not know, please write I do not know.	0.4	Fair-Moderate				
physical_activity Which of the following best describes your physical activity level at the time of your first period?	0.9	Near perfect				
activity_hours Around the time of your first period, how many hours per week were you physically active, on average?	0.323	Fair				
activity_change After your first period but before your next period, did your	0.159	Slight				

physical activity patterns CHANGE?						
side_effects Have you ever experienced any side effects from taking any form of birth control?	0.845	Near perfect				
SIDE_EFFECT_categorized (A variable created to analyze the number of birth control side effects selected by the respondents)	0.711	Substantial				

Table 3. Cohen's Kappas and Limits of Agreement for the HeRS section HS, Ages 13-18 (High School Age Years).

Coded variable Survey Question	Cohen's Kappa Value	Kappa Agreement	LOA N	LOA mean	LOA std	LOA std (95% conf interval)
hs_age At what age did you begin high school?	0.585	Moderate	144	-0.1111	0.7765	1.52194
hs_completion At what age did you end, complete, or graduate from high school?	0.728	Substantial	144	-0.0694	0.599	1.17404
hs_high_weight What is/was your highest weight (excluding pregnancy weight) between the ages of 13 and 18? Please report in pounds (exclude units). If you do not remember, please write I cannot remember.	0.051	Agreement equivalent to chance-Slight agreement	133	2.5121	2.5122	4.923912
hs_low_weight What is/was your lowest weight between the ages of 13 and 18? Please report in pounds (exclude units). If you do not remember, please write I cannot remember.	0.13	Agreement equivalent to chance-Slight agreement	125	-0.0711	4.5991	9.014236
hs_number_periods Between the ages of 13 and 18, approximately how many	0.551	Moderate	131		0.7786	1.526056

periods did you have per year, on average?				-0.0382		
hs_period_stop Between the ages of 13 and 18, did your periods ever stop for 2+ months without the use of a contraceptive means and/or in the absence of pregnancy?	0.848	Near perfect				
hs_age_period_stop Between the ages of 13 and 18, how old were you the first time your periods stopped for 2+ months without the use of a contraceptive means and/or in the absence of pregnancy?	0.605	Moderate-Substantial	43	0	0.8452	1.656592
hs_stop_length Between the ages of 13 and 18, what was the longest length of time you went without a period without the use of a contraceptive means and/or in the absence of pregnancy? Please report in months.	0.394	Fair-Moderate	44	1.4545	6.7046	13.141016
hs_pa_increase Between the ages of 13 and 18, did your menstruation change when you INCREASED your physical activity?	0.636	Substantial				
HS_PA_INC_categorized How did your menstrual cycle change when you INCREASED your physical activity?	0.69	Substantial				
hs_pa_decrease Between the ages of 13 and 18, did your menstruation change when you DECREASED your physical activity?	0.517	Moderate				
HS_PA_DEC_categorized How did your menstrual cycle change when you DECREASED your physical activity?	0.448	Moderate				
hs_miss_pa Between the ages of 13 and 18, did you ever have to miss a	0.532	Moderate				

training session or sport competition because of your menstrual cycle or related symptoms?						
HS_MISS_PA_categorized Between ages 13-18 which symptoms prevented you from training or sport comp	0.497	Moderate				
hs_high_performance Between the ages of 13 and 18, was there a point in your menstrual cycle when you could physically perform at a HIGHER level than your normal?	0.398	Fair-Moderate				
HS_HIGH_PERF_values Between 13-18, when during menstrual cycle did you perform at HIGHER level?	0.303	Fair				
hs_low_performance Between the ages of 13 and 18, was there a point in your menstrual cycle when you could physically perform at a LOWER level than your normal?	0.467	Moderate				
HS_LOW_PERF_values Between 13-18, when during menstrual cycle did you perform at HIGHER level? 1-Beginning, 2-Middle, 3-End, 4-Idk, 5-multiple answers	0.412	Fair-Moderate				
HS_MEDICAL_CONDITION Between 13-18, were you diagnosed with any of the following medical conditions?	0.677	Substantial				
hs_bc Between the ages of 13 and 18, did you use any form of birth control (not including condom use)?	0.9	Near perfect				
HS_BC_TYPE_values (Type of birth control used)	0.803	Substantial-Near perfect				

Table 4. Cohen's Kappas and Limits of Agreement for the HeRS section C, Ages 18-24 (College Age Years).

Coded variable Survey Question	Cohen's Kappa Value	Kappa Agreement	LOA N	LOA mean	LOA std	LOA std (95% conf interval)
college_high_weight What is/was your highest weight (excluding pregnancy weight) between the ages of 18 and 24? Please report in pounds (exclude units). If you do not remember, please write I cannot remember.	0.415	Fair-Moderate	141	0.0233	2.9395	5.76142
college_low_weight What is/was your lowest weight between the ages of 18 and 24? Please report in pounds (exclude units). If you do not remember, please write I cannot remember.	0.341	Fair	135	0.5396	3.8455	7.53718
college_height Approximately how tall were you between the ages of 18 and 24? Please report in inches (exclude units). If you do not remember, please write I cannot remember.	0.677	Substantial	138	0.2624	3.0011	5.882156
college_period_number Between the ages of 18 and 24, approximately how many periods did you have per year, on average?	0.559	Moderate-Substantial				
college_period_stop Between the ages of 18 and 24, did your periods ever stop for 2+ months without the use of contraception and/or in the absence of pregnancy?	0.808	Near Perfect				
college_period_stop_age Between the ages of 18 and 24, how old were you the first time your periods stopped for 2+ months without the use of contraception and/or in the absence of pregnancy?	0.59	Moderate-Substantial	44	-0.0909	0.8017	1.571332
college_stop_length Between the ages of 18 and 24, what was the longest length of time	0.172	Slight	19			

you went without a period without the use of contraception and/or in the absence of pregnancy? Please report in months.				-0.2632	12.6088	24.713248
college_pa_increase Between the ages of 18 and 24, did your menstruation change when you INCREASED your physical activity?	0.535	Moderate				
COLLEGE_PA_INC_categorized How did your menstrual cycle change when you INCREASED your physical activity?	0.561	Moderate				
college_pa_decrease Between the ages of 18 and 24, did your menstruation change when you DECREASED your physical activity?	0.465	Moderate				
COLLEGE_PA_DEC_categorized How did your menstrual cycle change when you DECREASED your physical activity?	0.49	Moderate				
college_pa_miss Between the ages of 18 and 24, did you ever have to miss a training session or sport competition because of your menstrual cycle or related symptoms?	0.454	Moderate				
COLLEGE_MISS_PA_categorized Between ages 13-18 which symptoms prevented you from training or sport comp?	0.537	Moderate				
college_high_performance Between the ages of 18 and 24, was there a point in your menstrual cycle when you could physically perform at a HIGHER level than your normal?	0.269	Fair				
COLLEGE_HIGH_PERF_values Between 19-24, when during menstrual cycle did you perform at HIGHER level?	0.369	Fair				
college_low_performance Between the ages of 18 and 24, was there a point in your menstrual cycle when you physically	0.165	Slight				

performed at a LOWER level than your normal?						
COLLEGE_LOW_PERF_values Between 19-24, when during menstrual cycle did you perform at LOWER level?	0.266	Fair				
COLLEGE_MEDICAL_CONDITIONS Between 18-24, were you diagnosed with any of the following medical conditions?	0.636	Substantial				
college_bc Between the ages of 18 and 24, did you use any form of birth control (not including condom use)?	0.811	Substantial-Near perfect				
COLLEGE_BC_TYPE_VALUES (Type of birth control used)	0.749	Substantial				

Table 5. Cohen's Kappas and Limits of Agreement for the HeRS section PC, Ages 25-40 (Post-College Age Years).

Coded variable Survey Question	Cohen's Kappa Value	Kappa Agreement	LOA N	LOA mean	LOA std	LOA std (95% conf interval)
pc_high_weight What is/was your highest weight (excluding pregnancy weight) between the ages of 25 and 40? Please report in pounds (exclude units). If you do not remember, please write I cannot remember.	0.289	Fair	101	0.1325	2.7768	5.442528
pc_low_weight What is/was your lowest weight between the ages of 25 and 40? Please report in pounds (exclude units). If you do not remember, please write I cannot remember.	0.307	Fair	106	-0.158	3.1539	6.181644
pc_height Approximately how tall were you between the ages of 25 and 40? Please report in inches (exclude	0.706	Substantial	103	0.1768	1.5331	3.00488

units). If you do not remember, please write I cannot remember.						
pc_period_number Between the ages of 25 and 40, approximately how many periods did you have per year, on average?	0.527	Moderate				
pc_period_stop Between the ages of 25 and 40, did your periods ever stop for 2+ months without the use of contraception and/or in the absence of pregnancy?	0.873	Near Perfect				
pc_period_stop_age Between the ages of 25 and 40, how old were you the first time your periods stopped for 2+ months without the use of contraception and/or in the absence of pregnancy?	0.577	Moderate	39	-0.1538	1.2884	2.525264
pc_stop_length Between the ages of 25 and 40, what was the longest length of time you went without a period without the use of contraception and/or in the absence of pregnancy? Please report in months.	0.403	Fair-Moderate	23	0.5652	6.7046	9.7790
pc_pa_increase Between the ages of 25 and 40, did your menstruation change when you INCREASED your physical activity?	0.695	Substantial				
PC_PA_INC_categorized How did your menstrual cycle change when you INCREASED your physical activity?	0.655	Substantial				
pc_pa_decrease Between the ages of 25 and 40, did your menstruation change when you DECREASED your physical activity?	0.472	Moderate				
PC_PA_DEC_categorized How did your menstrual cycle change when you DECREASED your physical activity?	0.552	Moderate				
pc_pa_miss Between the ages of 25 and 40, did you ever have to miss a training	0.521	Moderate				

session or sport competition because of your menstrual cycle or related symptoms?						
PC_MISS_PA_categorized Between ages 25-40 which symptoms prevented you from training or sport comp?	0.691	Substantial				
pc_high_performance Between the ages of 25 and 40, was there a point in your menstrual cycle when you could physically perform at a HIGHER level than your normal?	0.429	Fair-Moderate				
PC_HIGH_PERF_values Between 19-24, when during menstrual cycle did you perform at HIGHER level?	0.479	Moderate				
pc_low_performance Between the ages of 25 and 40, was there a point in your menstrual cycle when you physically performed at a LOWER level than your normal?	0.469	Moderate				
PC_LOW_PERF_values Between 19-24, when during menstrual cycle did you perform at LOWER level?	0.569	Moderate-Substantial				
PC_MEDICAL_CONDITION_values Between 25-40, were you diagnosed with any of the following medical conditions?	0.622	Moderate-Substantial				
pc_bc Between the ages of 25 and 40, did you use any form of birth control (not including condom use)?	0.762	Substantial				
PC_BC_TYPE_values (Type of birth control used)	0.62	Moderate-Substantial				

4.3 Recall Reliability of Menarche Questions by Current Age

Cohen's Kappas and limits of agreement of the first section of the survey (questions regarding menarche), were analyzed by current age, providing information related to whether older or younger individuals had better recall reliability. Table 6 shows the results of this analysis.

Recall reliability for the menarche section of the HeRS based on current age showed very mixed results. Younger populations (18-24, n=30) had the strongest recall reliability for some questions, other questions had the strongest recall reliability in the oldest population (35+, n=36), while other questions had the best recall reliability in the mid-range age groups (25-29, n=48; 30-34, n=28).

Regarding age at menarche, the mid-range age group of 30-34 was the only group with perfect agreement (kappa=1), while the oldest and youngest groups had near perfect agreement, and the 25-29 age range had substantial agreement (kappa=0.766). The youngest age group showed greatest recall reliability regarding the regularity of one's cycle after their second period (kappa=0.667, Substantial agreement), but the lowest recall reliability related to side effects experienced from taking birth control (0.751, Substantial agreement; age ranges 25-10, 30-34, 35+ = Near perfect agreement).

Regarding physical activity level at the time of menarche, agreement was high in all age ranges when asked the categorical question (Which of the following best describes your physical activity level at the time of your first period? Very physically active, somewhat physically active, not physically active) (18-24=Perfect agreement, 25-29=Substantial agreement, 30-34=Near-perfect agreement, 35+=Perfect agreement), but low regarding the exact number of physical activity hours per week (18-24=Slight agreement, 25-29=Fair agreement, 30-34=Moderate agreement, 35+=Fair agreement). The older age ranges had the best agreement regarding hours of physical activity per week at the time of menarche with 30-34=0.5, moderate agreement and 35+=0.393, fair agreement.

The question regarding change in activity level between one's first and second period showed no agreement for the first two age groups (18-24=-0.015; 25-29=0.111), and fair agreement in the older two age groups (30-34= 0.288; 35+= 0.311).

Table 6. Cohen's Kappas and Limits of Agreement to the HeRS section M, Regarding Menarche, by Respondents' Current Age.

Age Group (N)	18-24 (30)	25-29 (48)	30-34 (28)	35+ (36)
Question				
(first_period_age) How old were you the first time you had your period?	Kappa: 0.823 Near Perfect	Kappa: 0.766 Substantial	Kappa: 1 Perfect	Kappa: 0.829 Near Perfect
(weight) Approximately how much did you weigh the first time you had your period? Please report in pounds. If you do not remember, please write I cannot remember.	Kappa: 0.114 Slight Agreement LOA: 1.0019 +/- 3.7220	Kappa: 0.033 Agreement equivalent to chance LOA: .0021 +/- 3.1290	Kappa: 0.127 Slight Agreement LOA: .4771 +/- 2.7632	Kappa: 0.094 Agreement equivalent to chance LOA: 1.1981 +/- 6.6337
(height) Approximately how much did you weigh the first time you had your period? Please report in pounds. If you do not remember, please write I cannot remember.	LOA: .1327 2 +/- 2.7806	LOA: .9774 +/- 4.0176	LOA: .1133 +/- 3.2128	LOA: .3032 +/- 2.2341
(first_period_length) Approximately how much did you weigh the first time you had your period? Please report in pounds (exclude units). If you do not	Kappa: 0.476 Moderate	Kappa: 0.541 Moderate	Kappa: 0.28 Fair	Kappa: 0.728 Substantial

remember, please write I cannot remember.				
(second_period) After your first period stopped, when did you get your next period?	Kappa: 0.286 Fair	Kappa: 0.44 Moderate	Kappa: 0.19 Slight-Fair	Kappa: 0.496 Moderate
(regularity) After your first period stopped, when did you get your next period?	Kappa: 0.667 Substantial	Kappa: 0.556 Moderate	Kappa: 0.372 Fair	Kappa: 0.49 Moderate
(mom_period) After your first period stopped, when did you get your next period?	LOA: -0.0833 +/- .2887	LOA: .0333 +/- .4806	LOA: .2000 +/- .7888	LOA: .0833 +/- 1.0206
(physical_activity) Which of the following best describes your physical activity level at the time of your first period?	Kappa: 1 Perfect	Kappa: 0.692 Substantial	Kappa: 0.917 Near Perfect	Kappa: 1 Perfect
(activity_hours) Around the time of your first period, how many hours per week were you physically active, on average?	Kappa: 0.153 Slight	Kappa: 0.273 Fair	Kappa: 0.5 Moderate	Kappa: 0.393 Fair
(activity_change) After your first period but before your next period, did your physical activity patterns CHANGE?	Kappa: -0.015 No Agreement	Kappa: 0.111 No Agreement	Kappa: 0.288 Fair	Kappa: 0.311 Fair
(side_effects) Have you ever experienced any side effects from taking any form of birth control?	Kappa: 0.751 Substantial	Kappa: 0.862 Near Perfect	Kappa: 0.874 Near Perfect	Kappa: 0.862 Near Perfect

4.4 Physical Activity Level and BMI relation to Age at Menarche

Respondents (76%) reported reaching menarche between the ages of 12-15, while 16.7% of respondents reported reaching menarche at age 11 or younger, and 6.9% of respondents reported reaching menarche at age 16 or older (indicative of primary amenorrhea).

The average reported hours of physical activity around the time of menarche were 8.45 +/- 6.05 hours (activity_hours_4mo). At the time of menarche, 41.9% of respondents self-identified as competitive athletes, 24.3% as recreational athlete, and 34% as non-athletes.

Figure 3 groups respondents based on their age at menarche layered by whether they self-identified as a competitive athlete, recreational athlete, or non-athlete, and plots the average, max and minimum of physical activity hours per week for each group.

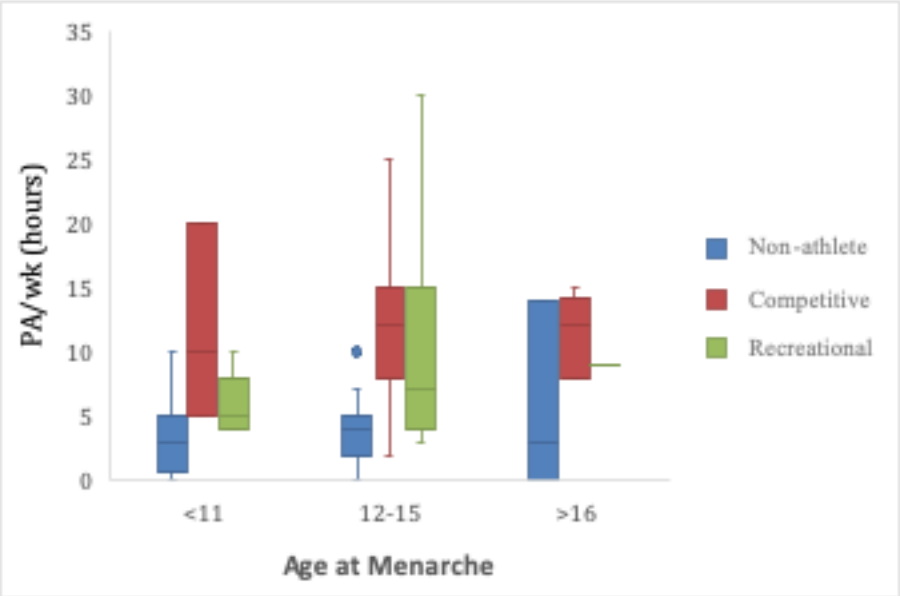

Figure 3. Reported Age at Menarche by Average Hours of Physical Activity Being Performed Each Week in Self-Identifying Competitive Athletes, Recreational Athletes, and Non-Athletes.

Average BMI at the age of menarche was 20.15 +/- 2.884, with a minimum of 12.86 and a maximum of 36.56. Only 67.4% (n=97) of respondents reported a BMI at menarche, while the number of respondents that could not remember either their weight (n=42) and/or height (n=34) at menarche was significant. Full descriptive data for these variables can be found in the demographics section of Appendix B.

Figure 4 groups respondents based on their age at menarche layered by whether they self-identified as a competitive athlete, recreational athlete, or non-athlete, and plots the average, max and minimum BMI of each group.

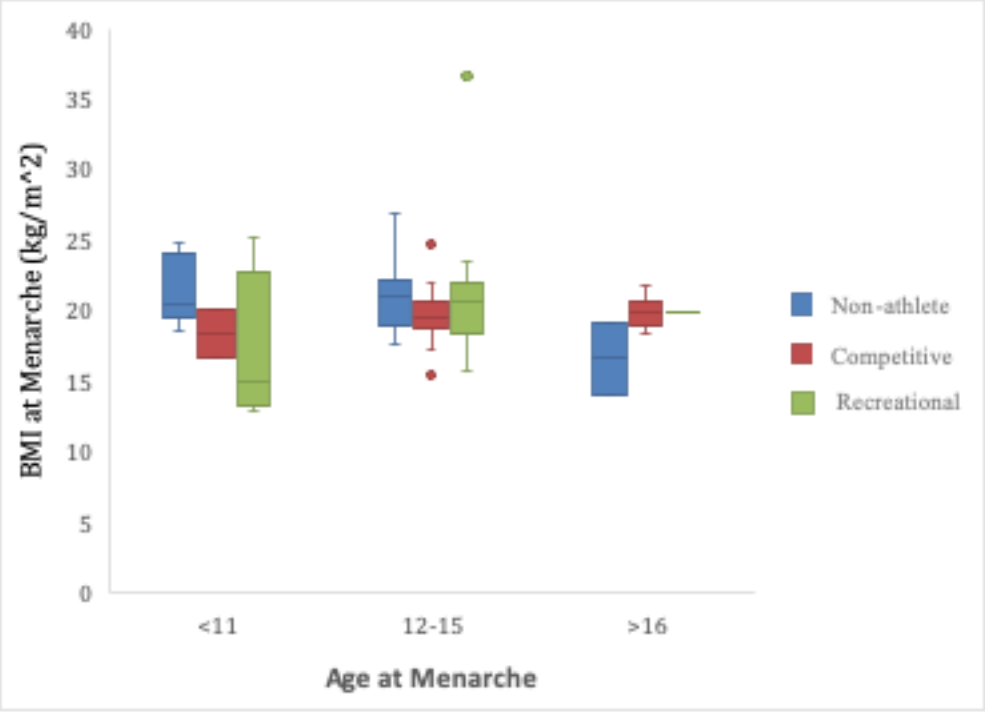

Figure 4. Reported Age at Menarche by BMI in Self-Identifying Competitive Athletes, Recreational Athletes, and Non-Athletes.

4.5 Physical Activity Level by Number of Menstrual Cycles of Competitive Athletes and Disordered Cycles

The majority of respondents reported a regularly occurring menstrual cycle (10-12 cycles per year) at each age range (HS: 56.9%; C: 58.3%; PC: 50%, n=108). Among exclusively competitive athletes, the majority still reported a regularly occurring menstrual cycle at each age group (HS:59.0%, n=78; C: 64.6%, n=48; PC:46.2%, n=13).

The average range of hours of physical activity performed by competitive athletes during the high school age was 10.6 +/- 3.54 (n=78), during the college age was 14.5 +/- 4.70 (n=48), and during the post-college age was 3.4 +/- 6.53 (n=13). Figure 5 shows the average number of menstrual cycles based on physical activity and survey recall age group.

Full descriptive data of these variables can be found in the demographics section of Appendix B.

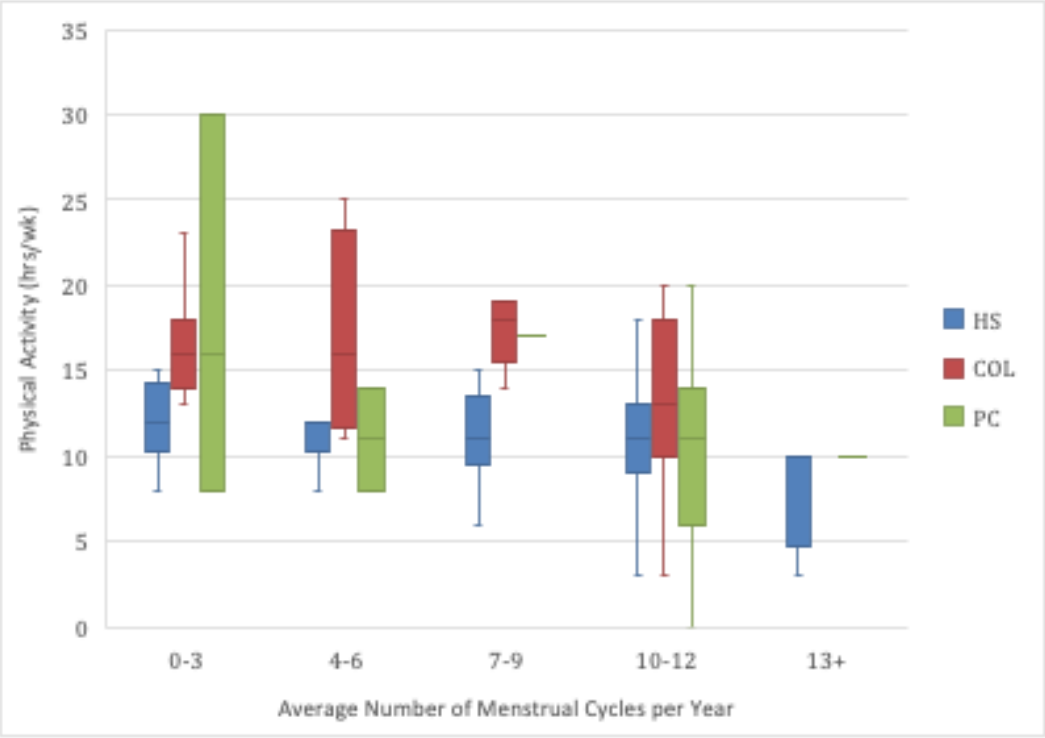

Figure 5. Average Number of Menstrual Cycles Per Year by Average Physical Activity Level at the High School Age (13-18), College Age (18-24), and Post-College Age (25-40) of Self-Identifying Competitive Athletes.

The number of all respondents diagnosed with menstrual cycle disorders increased from 26 during the high school age range (18.1%, N=144) to 39 during the college age range (27.1%, N=144). This number stabilized into the post-college age range, with 39 respondents (36.1%, N=108) reporting diagnosed menstrual cycle disorders well into adulthood (see Table 7).

Table 7. Percentage of Respondents per Age Range Diagnosed with Disordered Menstrual Cycles (Amenorrhea, Oligomenorrhea, Polymenorrhea, Female Athlete Triad, or RED-S).

	Respondents Diagnosed with Disordered Menstrual Cycles	
Survey Age Section	N	%
13-18 (n=144)	26	18.1%
18-24 (n=144)	39	27.1%
25-40 (n=108)	39	36.1%

The most common diagnosed menstrual cycle disorder reported by respondents is shown in Table 8. Across all age ranges, amenorrhea (HS:16%, n=23; C: 25%, n=36; PC: 27%, n=39), and the female athlete triad (HS: 2.8%, n=4; C:6.3%, n=9; PC: 3.5%, n=5) were the most commonly diagnosed menstrual cycle disorders.

Table 8. Percentage of Respondents Diagnosed with Disordered Menstrual Cycles (Amenorrhea, Oligomenorrhea, Polymenorrhea, Female Athlete Triad, or RED-S) During HS, C, and PC.

	SURVEY AGE SECTION					
MENSTRUAL CYCLE DIAGNOSIS	13-18 (n=114)		18-24 (n=114)		25-40 (n=108)	
	n	%	n	%	n	%
Amenorrhea	23	16%	36	25%	39	27%
Oligomenorrhea	1	0.7%	4	2.8%	0	0%

Polymenorrhea	1	0.7%	1	0.7%	0	0%
Female Athlete Triad	4	2.8%	9	6.3%	5	3.5%
RED-S	3	2.1%	6	4.2%	2	1.4%

*respondents could mark multiple diagnosis within each age range

Of those diagnosed with menstrual cycle disorders at the high school age range, non-athletes showed the highest percentage of diagnosed disordered cycling (31.4%, n=11/26) while recreational athletes showed the highest percentage of diagnosed disordered cycling within the college and post-college age ranges (C: 34.4%, n=22/39; PC: 37.5%, n=27/39) (see Table 9).

Table 9. Frequency of Menstrual Cycle Disorder Diagnosis by Self-Identified Athlete Status.

	Percentage of Athlete Classification Diagnosed with Menstrual Disorder					
Self-identification of Athlete Status	13-18 (n=26)		18-24 (n=39)		25-40 (n=39)	
	n	%	n	%	n	%
Competitive Athlete	7	26.9%	11	28.2%	3	7.7%
Recreational Athlete	8	30.8%	22	56.4%	27	69.2%
Non-Athlete	11	42.3%	6	15.4%	9	23.0%

4.6 Change of Physical Activity Levels and Characteristics of Menstrual Cycle

Analysis revealed that nearly a third of all respondents (30.6%) had noticeable changes to their menstrual cycle characteristics (i.e., intensity, frequency, and duration) when they increased their physical activity level between the ages of 13-18 (see Table 10). This percentage of respondents decreased between the ages of 18-24 (12.5%), then increased again to nearly the same level at the age range of 25-40 (N=114, 29.6%). The percentage of respondents that reported noticeable changes to menstrual cycle characteristics attributed to a decrease in physical activity was much lower across all age ranges (13-18: 12.5%; 18-24: 17.4%; 25-40: 19.4%).

Table 10. Reported Noticeable Changes to Menstrual Cycle Characteristics During an Increase or Decrease in Physical Activity Levels Throughout Survey Age Range Sections.

		Survey section age groups		
		13-18	18-24	25-40*
Did your menstruation change when you INCREASED your physical activity?	YES	30.6%	12.5%	29.6%
	NO	54.2%	54.9%	60.2%
	I do not know/ I cannot remember	15.3%	25%	10.2%
Did your menstruation change when you DECREASED your physical activity?	YES	12.5%	17.4%	19.4%
	NO	62.5%	63.2%	70.4%
	I do not know/ I cannot remember	25%	19.4%	10.2%

*N=114.

The most common menstrual cycle characteristics reported with an increase in physical activity were decreased frequency (22.2%), followed by decreased intensity (7.6%) and duration (7.6%). The most common menstrual cycle characteristics reported with a decrease in physical activity was an increase in frequency (8.3%) followed by an increase in intensity (7.6%) (see Table 11).

Table 11. Menstrual Cycle Characteristics Influenced by an Increase or Decrease in Physical Activity Across Survey Section Age Ranges.

		Survey section age group		
		13-18	18-24	25-40*
How did your menstruation change when you INCREASED your physical activity?	Increased intensity	1.4%	0%	0%
	Increased frequency	0.7%	3.5%	0.9%
	Increased duration	0.7%	0.7%	0%
	Decreased intensity	7.6%	16%	12.3%
	Decreased frequency	22.2%	21.5%	18.4%
	Decreased duration	7.6%	10.4%	10.5%
How did your menstruation change when you DECREASED your physical activity?	Increased intensity	7.6%	8.3%	7.9%
	Increased frequency	8.3%	11.1%	14%
	Increased duration	4.2%	4.2%	5.3%
	Decreased intensity	0%	0%	0%
	Decreased frequency	0.7%	1.4%	0.9%
	Decreased duration	0.7%	0%	0%

*N=114.

4.7 Women Reporting the Use of Birth Control by Athletic Self-Identification

Out of the total 144 respondents, 86.11% said they had used some form of birth control besides condoms at some point during their life.

During the high school age years (13-18), recreational athletes were the highest subgroup which reported using birth control (54.3%; n=35) followed closely by non-athletes (51.6%; n=31), and then by competitive athletes (33.3%; n=78). The number of respondents that identified as competitive athletes dropped significantly into the college age range (from n=78 to n=48) as the number of recreational athletes increased (n=35 to n=64). This time period had the highest overall reported use of birth control across athlete type (comp=62.5%; rec=78.1%; non=78.1%). By the post-college age years (25-40; n=114), recreational athletes remained the largest group by athlete type (n=75) and had the highest percentage of birth control use (64%). The number of competitive athletes within this age group decreased even further (n=14), with half reporting the use of birth control (50%).

Across age ranges and athlete self-identification types, oral contraceptives were the most widely used form of birth control (see Tables 12-17) (HS: comp=28.3%, rec=45.7%, non=32.3%; C: comp=56.3%, rec=45.3%, non=59.4%; PC: comp=35.7%, rec=37.3%, non=23.7%).

Table 12. Birth Control Use by Self-Identified Athlete Type Between Ages 13-18 (High School Age Years)

	Respondents' use of birth control	
Self-identified Athlete Type	YES	NO
Competitive Athlete (n=78)	33.3%	66.7%
Recreational Athlete (n=35)	54.3%	45.7%
Non-Athlete (n=31)	51.6%	48.4%

Table 13. Form of Birth Control Used by Self-Identified Athlete Type Between Ages 13-18 (High School Age Years)

	Form of Birth Control	Percentage respondents
Competitive Athlete (n=78)	Oral contraceptive	28.3%
	Non-oral contraceptive	1.3%
	Other	1.3%
	Multiple forms of BC during this time frame	5.1%
	None	59%
	I do not know/ I cannot remember	5.1%
Recreational Athlete (n=35)	Oral contraceptive	45.7%
	Non-oral contraceptive	0%
	Other	0%
	Multiple forms of BC during this time frame	0%
	None	54.3%
Non-Athlete (n=31)	Oral contraceptive	32.3%
	Non-oral contraceptive	0%
	Other	3.2%
	Multiple forms of BC during this time frame	0%
	None	64.5%

Table 14. Birth Control Use by Self-Identified Athlete Type Between Ages 18-24 (College Age Years)

	Respondents' use of birth control	
Self-identified Athlete Type	YES	NO
Competitive Athlete (n=48)	62.5%	37.5%
Recreational Athlete (n=64)	78.1%	21.9%
Non-Athlete (n=32)	78.1%	21.9%

Table 15. Form of Birth Control Used by Self-Identified Athlete Type Between Ages 18-24 (College Age Years)

	Form of Birth Control	Percentage respondents
Competitive Athlete (n=48)	Oral contraceptive	56.3%
	Non-oral contraceptive	2.1%
	Other	0%
	Multiple forms of BC during this time frame	6.3%
	None	27.1%
	I do not know/ I cannot remember	4.2%
Recreational Athlete (n=64)	Oral contraceptive	45.3%
	Non-oral contraceptive	3.1%
	Other	1.6%
	Multiple forms of BC during this time frame	15.6%
	None	31.3%
Non-Athlete (n=32)	Oral contraceptive	59.4%
	Non-oral contraceptive	9.4%
	Other	0%
	Multiple forms of BC during this time frame	12.5%
	None	18.8%

Table 16. Birth Control Use by Self-Identified Athlete Type Between Ages 24-40 (Post-College Age Years)

	Respondents' use of birth control	
Self-identified Athlete Type	YES	NO
Competitive Athlete (n=14)	50%	50%
Recreational Athlete (n=75)	64%	36%
Non-Athlete (n=38)	34.2%	65.8%

Table 17. Form of Birth Control Used by Self-Identified Athlete Type Between Ages 24-40 (Post-College Age Years)

	Form of Birth Control	Percentage respondents
Competitive Athlete (n=14)	Oral contraceptive	35.7%
	Non-oral contraceptive	7.1%
	Other	0%
	Multiple forms of BC during this time frame	0%
	None	57.1%
Recreational Athlete (n=75)	Oral contraceptive	37.3%
	Non-oral contraceptive	17.3%
	Other	1.3%
	Multiple forms of BC during this time frame	5.3%
	None	37.3%
Non-Athlete (n=38)	Oral contraceptive	23.7%
	Non-oral contraceptive	5.3%
	Other	0%
	Multiple forms of BC during this time frame	5.3%
	None	65.8%

CHAPTER V

DISCUSSION

5.1 General Findings about the Health and Reproductive Survey

5.1.1. Excluded questions from recall analysis and other analysis, and suggestions for edits to the HeRS before future administration

HeRS questions were dropped from recall reliability testing if they did not provide valuable insight into survey recall (i.e., The Cohen's Kappa of complete agreement regarding the question "How many biological sisters do you have?" carries little weight in the grand scheme of reproductive surveys), or when survey design or poor wording of questions resulted in skewed and unreliable respondent responses. The justification for each follows.

With regard to the wording of questions, an excellent illustrative example is the question related to height between the ages of 13-18 (hs_height). While this same section asked for the respondent's highest and lowest weights during high school, it did not do the same thing for height. While this may make sense in other sections of the survey when adult height has been attained and the female is fully grown, ages 13-18 represents a developmental window that encompasses linear growth for most girls, thus a significant change in height across this age range is likely. Therefore, respondents may have answered this question by taking their average height, their height at age 13 or their height at age 18. This was evidenced by a Cohen's Kappa for height between the ages of 13-18 with no agreement, and the LOA was extremely poor (-0.3909 +/- 8.39, min=-20.32, max=8.39).

Another question - as well as the categorical variable created with it during analysis - was assessing changes in menstrual cycle characteristics (duration, flow, frequency, etc.) (hs_pa_change) due to changes in physical activity. While the Cohen's Kappa for this variable was substantial, respondents showed contradictions in answering this question and the questions that followed asking more specifically about an increase or decrease in physical activity. For example, some respondents answered "no" to the question about whether they experienced a change in menstrual cycle due to a *change* in physical activity, yet they answered "yes" for

whether they experienced a change in menstrual cycle due to an *increase/decrease* in physical activity. The directionality of the latter questions provided more specific information and makes interpretation of the data collected on the first question problematic—since it combines directionality (increased and decreased) into a single question.

After the first round of data collection, clarity around athletic performance and physical activity participation was needed. Several questions were added related to self-identification of respondents as a competitive or recreational athlete, and questions pertaining to the number of days and hours of physical activity/exercise/training pertaining to these sports. Since these questions were added to the second recall (T4mo), there was no way to calculate recall reliability for these questions and thus, they were dropped from this section of the analysis.

Some of these questions excluded from recall reliability analysis were used in subsequent analysis regarding physical activity at menarche, physical activity and corresponding number of menstrual cycles/diagnoses of disordered cycles, and self-identified athlete type related to birth control use. Other questions were excluded from analysis altogether. For instance, type of sport participation was not used at all within this analysis, and all data regarding recreational sport hours of participation were disregarded. These latter questions were excluded from all analysis because it became evident that the wording of the questions (regarding the number of days per week and hours per day of physical activity) led to misinterpretation of the question by many respondents, since values reported exceeded reasonable amounts of exercise time per week (i.e., 46 hours or 38 hours). This issue is not uncommon with self-report physical activity questionnaires, since many surveys report capping or eliminating data that seems excessive for exercise participation (Reifsteck, 2021).

Other criticisms and necessary changes to be considered for the HeRS before future administration include the overlap of age for high school (13-18) and college (18-24) sections, as well the need to include questions on activity level within each age section. Regarding the overlap of the high school and college age range (13-18) and (18-24), since both include 18, this is confusing for respondents. One of these needs to be changed; either the high school age should be changed to 13-17, or the college age should be changed to 19-24. Before the sections of

competitive or recreational athlete physical activity hours were added to the HeRS T4mo, respondents were only questioned about their physical activity participation at the time of menarche. Meanwhile these sections still asked other questions regarding physical activity's impact on one's menstrual cycle characteristics and whether they were diagnosed with menstrual cycle disorders relative to energy availability, yet they never asked to clarify average intensity or number of hours of physical activity participation within these age ranges outside of menarche. Adaptations to these questions should be considered before the next administration of the HeRS.

Finally, the length and repetitive nature of questions within each section of the HeRS should be acknowledged. Certain questions do not provide additional valuable information but instead add to the repetitive nature of the survey, leading to potential frustration for the respondent. For instance, the question regarding how a change in physical activity impacts menstrual characteristics could be dropped since the questions immediately following this ask specifically how an increase or decrease of physical activity impacts menstrual characteristics. Other questions that revealed low recall reliability and that may not provide much insight into analysis such as the age at which periods may have stopped for 2+ months and the longest length of time that periods stopped, should be considered for removal. Making the survey shorter in these areas could reduce survey fatigue and provide more accurate responses (Sinickas, 2007).

5.1.2. Innovative questions and information gathered by the HeRS

Evident from the lack of existing research, the HeRS is an innovative approach at observing the reproductive health history of women above the age of 18. The HeRS investigates topics of physical activity impacts on menstrual and reproductive health, the use of birth control among athletes and non-athletes and the reasoning for use, and the long term reproductive and health implications for disordered menstrual cycling especially at early ages, which are largely nonexistent in existing literature.

The HeRS includes questions regarding the physical activity level of adolescents at menarche, which could provide significant insight into primary amenorrhea and whether there is a direct correlation with energy availability issues related to participation in physical activity, exercise or sport. It also delves into how an increase or decrease in physical activity may impact the

characteristics of one's menstrual cycle (frequency, duration, intensity) which is rarely discussed within existing literature. The current literature largely classifies individuals as having/not having amenorrhea, without looking at other cycle characteristics that could correlate to rates of other menstrual irregularities that are not reflected by the categorization of amenorrhea.

Finally, the HeRS may be one of the first surveys to investigate *why* individuals use birth control. This could provide significant insights into which competitive and recreational athletes, and what age groups, are using birth control for pregnancy avoidance, regulating menstrual cycles around competitions or because they were prescribed it by their physician due to concerns related to amenorrhea or the female athlete triad. Although beyond the scope of this thesis, future studies of these HeRS questions should be analyzed.

5.2 Recall Reliability

As predicted, recall of age at menarche showed significant agreement between survey timepoints with near perfect agreement (Kappa=0.832) and aligns with previous research regarding the recall reliability of age at menarche (Bergsten-Brucefors, 1976; Damon and Bajema, 1974; Holt et al., 1991; Must, 2002).

Respondent answers for weight and height at menarche were highly unreliable between timepoints with significant differences reported across the 2 timepoints, suggesting the inability for respondents to remember exact information about body size at the time of menarche. The differences between some respondents' answers would significantly skew the calculated BMI and thus could alter interpretation and relations of age at menarche, body composition and underlying energy availability. For example, a respondent that reported a height of 170.18 cm and weight of 55 kgs would have a calculated BMI of 19, which is considered normal. However, if they reported their weight within the 95% confidence interval range of error as 47 kgs, their calculated BMI would be 16.2, categorizing them as underweight. Since the specificities of the HPO axis and menstrual cycle in relation to energy availability was a significant point of interest in this analysis, such discrepancies in respondent answers make this data unreliable.

This is contradictory to previous research which showed correlation between BMI percentile at menarche and recalled body size at menarche (Must, 2002), although a systematic bias was evident within this previous study. It is possible that girls at either end of the reporting extremes (low or high body weight or height) are less likely to accurately remember their stature compared to individuals in the 'normative' range for height and weight. Nonetheless, the lack of reliability regarding height and weight at menarche results in some hesitation moving forward regarding the accuracy of the information for our research question pertaining to BMI and age at menarche.

The question of whether one's menstrual cycle started occurring on a regular basis (every 21-35 days) post second period (regularity) revealed moderate agreement. This aligns with previous research by Must (2002) which found that the recall of regularity of menstrual cycle to be poor, with the majority of errors in respondents classifying their cycles as irregular when they were not. While we have no medical records to judge respondent accuracy, reporting of irregular cycling (experiencing over 12 or under 10 menstrual cycles per year) within our data set was extremely high (over 40% within each age range section of the survey). Further analysis of menstrual cycle regularity will be discussed in section 5.5.

Recall of the age for mother's menarche showed substantial agreement (0.689), however, only 43 (29.9%) respondents provided an answer to this question. This may indicate that when there is conversation between mother and daughter about getting their first period, this is a significant enough event to attain substantial retention for a daughter, but this conversation may not occur for all respondents. Of the 114 sisters that were reported within the survey, respondents answered on the age at menarche for 84.3% of them, with recall reliability ranging from substantial to fair-moderate (Sister 1: 0.72, Substantial; Sister 2: 0.35, Fair; Sister 3: 0.40, Fair-moderate). Again, this could imply significant memory retention to events regarding menses for immediate family members. Although we did not ask about age gaps between sisters and the respondent, it is possible that sisters who are close in biological age and enter puberty and menarche in close temporal proximity, may remember these events more accurately than sisters who are further apart in age. This is a question that should be followed up in future research.

Recall of physical activity status (very active, somewhat active, or not active) at menarche proved to be highly reliable (near perfect agreement) between timepoints. While recall of physical activity has been studied widely with test-retest reliability as well as long-term recall validity (Blair, 1991; Brown, 2004; Falkner, 1999), our results are promising related to the recall reliability of physical activity status. This level of recall for physical activity status may be adequate for many research needs, but if the role of energy balance, menarche and athletic performance are of interest, this level of information is inadequate and does not provide the details necessary to fully elucidate the interplay between physical activity and onset of menarche.

Indeed, when we asked more specific details related to menarche and physical activity, the reported number of hours of physical activity at menarche was only fairly reliable (fair agreement). This may be attributed to the difference in question presentation between T1 and T4mo. T1 provided a categorical selection of hours of physical activity (Not physically active; <5 hours; 5-10 hours; 11-15 hours; 16-20 hours; >20 hours; I cannot remember), while T4mo asked the open-ended question "How many hours per week were you physically active, on average?" allowing respondents to enter any value. These T4mo values were then categorized manually into the T1 boxes to calculate a kappa value. The kappa value here should be considered with some suspicion, since it is unclear if the lack of recall reliability is related to a difference in question presentation or truly poor recall.

Instead, there could be merit to integrating an existing and validated physical activity survey into the HeRS. One such as the Kaiser Physical Activity Survey (KPAS) would encapsulate a broad range of physical activity habits (i.e., occupation, sports, active living habits, etc.) (Ainsworth, 1999). While the International Physical Activity Questionnaire (IPAQ) would account for varying intensity levels of physical activity (Craig, 2003).

Respondents' recall of high weight, low weight, and height improved with age with post-college aged women having better recall reliability for height and high and low weight which would be expected given the fewer number of years between the time being recalled (Rubin and Baddeley, 1989). However, the minimum and maximum values still show high variability of responses for

weight and height. The variability in responses regarding height seems especially alarming since height among most individuals should be relatively stable during the adult years (ages 25-40).

Recall regarding the average number of cycles per year remained relatively stable and reliable throughout age ranges of the survey, resulting in a mediocre recall reliability of average menstrual cycles over a vast time span. This is contradictory with previous research which shows high reliability related to menstrual patterns (Kappa=0.68) (Bosetti, 2001) and cycle length (Bachand, 2009). Recall of whether one's period stopped for more than two months significantly increased across the age ranges of the survey. This increased reliability could be explained by several factors. First, the older age groups may be more conscious about missed menstrual cycles, either due to greater regularity of menstruation compared to high school age years, greater consciousness given sexual activity and the chance of pregnancy or concentrated efforts to get pregnant (fertility issues).

Meanwhile, highly variable responses were reported for the longest time without a menstrual cycle. This could be interpreted in a number of ways: individuals either missed their menstrual cycles often enough that they could not attribute a value with any significant reliability, or it was more an occasion to receive one's menstrual cycle than miss it, so months of missing cycles were not being counted. In other words, in females with highly irregular menstrual cycles and longtime frames without cycles, where there was perhaps a performance benefit to having no cycle or missing it often, there would be little or no reason to take notice of missing cycles (or remember the numbers accurately).

The impact of a change in physical activity on menstrual cycle characteristics (i.e. intensity, duration, and flow) revealed recall reliability kappa values showing only moderate level of agreement and suggests that most women likely don't track menstrual cycle characteristics unless they have a medical or personal reason to do so.

Finally, the use of birth control – as both the yes/no question of use during the time frame, as well as the categorical variable that asked for the specific form of birth control used – both revealed high recall reliability. This may reflect several issues for women: 1) the significance of

birth control use across the lifetime, 2) the effort one must go to not only for obtaining birth control in the first place but keeping an active prescription (i.e., yearly gynecological exams, etc.), 3) the reasons behind using it, and 4) the side effects from using birth control—some of which are highly disruptive for some women. No other existing studies were found regarding the recall reliability of birth control use over significant timeframes as reflected in our current survey.

While recall reliability of some questions was extremely high (i.e. age at menarche), others were extremely low (i.e. height and weight at menarche). It is possible that survey design (length and repetition of questions) and implementation potentially damaged recall validity between survey timepoints through survey fatigue. Asking respondents to take the survey twice within a relatively short time period (4 months) without telling them any results or findings of the previous survey could have caused respondents to believe that their input did not matter as much (Sinickas, 2007). Poor survey design (discussed within the previous section 5.1.1.) that included many repetitive questions and questions for which the respondents could not easily glean importance, may have also contributed to survey fatigue as respondents may have felt that a poorly constructed survey was not worth their utmost effort (Sinickas, 2007).

5.3 Recall Reliability of Menarche Questions by Current Age

Recall reliability of the menarche section of the HeRS grouped by current age revealed similar recall reliability of menarche and events surrounding that time period. This is counter to our hypothesis that older age groups would have less recall reliability than younger age groups.

Specific to age at menarche, all current age groupings had either perfect agreement or near perfect agreement. Bergsten-Brucefors (1976) found that when recall of age at menarche was about four years since the time it occurred, the correlation between actual and reported age was 0.81, and most errors (63%) were less than three months. Damon and Bajema (1974) found that when recall of age at menarche was 39 years away, the correlation was 0.61 with half (50%) of errors less than six months from the true date, which is actually quite extraordinary. While these

two studies align with the ideology of Holt et al. (1991) that there is a positive relation of magnitude of error and length of recall, analysis of the HeRS shows just as high of recall at the older age groups as the younger age groups, which is promising. However, it is important to note that in the current study, classification of age at menarche was within categorical groups (i.e. <11, 12-15, 16+) and respondents simply had to pick the same categorical group each time. While this categorical grouping of age at menarche may provide less specific data, it also is likely to significantly reduce the likelihood of error.

These high values for recall reliability of age at menarche align with previous research suggesting that the retention of accurate memory relies most heavily on the subject matter being recalled (i.e. the saliency of the event), and less about the elapse of time between the recall and event (Cannell and Henson, 1974; Mathiowetz and Duncan, 1998). Given the shocking and oftentimes traumatic experience of one's first menstrual cycle, and the high recall reliability rates, it seems reasonable to classify menarche as one such salient event. `

However, the ideal situation is to be able to check not just recall reliability but the accuracy of the responses against independent medical records (Dex, 1995), but that was not possible in the current study. Thus, it is possible that although older age groups do not appear to be less reliable between timepoints, their answers could be less accurate overall. This would align with Holt et al.'s (1991) study that found a positive relation between magnitude of error and length of recall regarding age at menarche.

Other variables within the menarche section reveal further evidence that current age appears to play a minimal role in recall reliability between time points. Length of one's first menstrual cycle (first_period_length) showed the oldest age group (35+) to have the highest agreement, while the two youngest age groups (18-24, 25-29) had moderate agreement. The question about the menstrual cycle becoming regular prior to their second cycle showed the youngest age group to have the highest agreement (closest proximity to event), followed by the middle (25-29) and oldest age group (35+), while the 30-34 age group had the least agreement between recalls.

Lastly, the question which asked whether respondents ever experienced any side effects from taking birth control showed relatively high agreement across all current age ranges. This may, once again, signify that pain or ill feelings caused from birth control are more salient experiences due to the conscious decision a woman must make in taking a hormonal supplement that can have serious impacts on one's physiology and psychology, and thus, more reliable to recall well into older ages (Cannell and Henson, 1974; Mathiowetz and Duncan, 1998). However, this was also a yes/no categorical question, so while Cohen's Kappa does account for the possibility of chance selection, it also means respondents were much more likely to choose the same answer twice.

5.4 Physical Activity Level and BMI Relation to Age at Menarche

While it is widely accepted that high energy expenditure may produce hormone deficiencies (Reed, 2018) and high-intensity training may delay the onset of menarche (Dusek, 2001), our results only mildly support this research.

While our results showed that competitive athletes have the highest percentage of respondents that experienced primary amenorrhea (reached menarche after the age of 15) (10%; compared to 2.9% of recreational athletes and 6.1 of non-athletes), the competitive athletes within this group did not report higher hours of physical activity participation than those who experienced menarche at younger ages. Our results show about half the competitive athletes reaching menarche below the age of 12 (early menarche) and had higher reported physical activity levels than those who experienced primary amenorrhea. The largest portion of respondents had a normative age at menarche (12-15; 109 respondents), which also contained the highest and lowest values of reported physical activity hours per week.

Non-athletes also showed great variability in reported physical activity hours and age at menarche. Non-athletes had the highest percentage of respondents that experienced early menarche (11 or younger; 20.4%), but barely above recreational athletes (20%). On the other side of the spectrum, they also had a significant percentage that experienced primary amenorrhea

(6.1%), which could indicate high energy availability (possible obesity) associated with menstrual irregularities (Sharma, 2013; Talmor, 2015).

Overall, our results pertaining to 144 respondents of the HeRS don't match up with values from current literature. While 10% of competitive athletes in our study had primary amenorrhea and this aligns closely to Beals' (2002) finding that 7.4% of 425 college athletes experienced primary amenorrhea, our overall percentage of respondents that experienced primary amenorrhea (6.9% overall, or 6.06% of the non-competitive athlete population) far exceeds the reported <1% of the general population (Chumlea, 2003).

While the use of energy availability as a potential factor impacting age at menarche may seem unreliable given our lack of knowledge of caloric intake by individuals, further analysis of BMI confirms these wavering results. Corresponding to the research on energy availability and hormonal deficiencies, lower BMI and subcutaneous fat levels are often associated with later menarche (Lagowska & Kapczuk, 2016). However, our results are very indeterminate. In the competitive athlete category, those who experienced primary amenorrhea showed the same or higher BMIs than those who experienced normal or even early menarche. Recreational athletes showed the same average BMI no matter the age at menarche. Non-athletes were the only group which presented a distinct change in average BMI; those experiencing early menarche with the highest BMIs, normal menarche with medium BMIs, and primary amenorrhea with the lowest BMIs. This is the only group which aligns with the energy availability theory according to BMI.

Our results must be viewed with caution, there are numerous issues with physical activity reporting and BMI that we have already addressed and the women self-selected designation as a recreational vs competitive athlete. In addition, we did not ask women to identify the types of sports they were competing in and thus, it is possible that our competitive athletes were all participating in sports where size (BMI) matters less (i.e., basketball, volleyball) or where being bigger is advantageous (i.e., rugby, football). Of additional consideration is that in the era of early specialization in a highly competitive sporting environment, being more mature at a younger age is actually advantageous. Thus, it is possible that the highly competitive sport selection process favors girls that actually mature early (early linear growth, higher training

capacity, more years for skill development at full adult height) in sports that do not require small size or aesthetics (i.e., gymnastics, figure skating, diving). Further research should be done on the HeRS regarding specific sport participation, as Beals (2002) reported an increase of primary amenorrhea to 22.2% of athletes within aesthetic sports. Also, greater analysis could be done on the intensity of physical activity, as those who reported high hours of physical activity may be doing so at a low intensity and vice versa, which may skew our perception of energy availability.

5.5 Physical Activity Level by Number of Menstrual Cycles and Disordered Cycles

Within our entire dataset, less than 60% of respondents reported having regularly occurring menstrual cycles (10-12 cycles per year) at each age range (HS: 56.9%; C: 58.3%; PC: 50%, n=108). This equates to over 40% of women at each age range experiencing some sort of irregular cycles that led them to experience more than 12 menstrual cycles or less than 10 cycles per year. The number of respondents that experienced less than 10 menstrual cycles per year (amenorrhea or oligomenorrhea) was 30.5% at the high school age, 36.1% at the college age, and 34.7% at the post-college age. These numbers far exceed that of current research reporting amenorrhea and oligomenorrhea in the general population of 5% (Singh, 1981) or 1.8% (Peterson et al., 1973).

Respondents that reported actual diagnosis of disordered menstrual cycles was less than the percentage of an irregular number of cycles, except at the post-college age (HS: 18.1%; C: 27.1%; PC: 36.1%), but still much higher than current literature on the general population. These numbers regarding diagnosis likely differ from respondent reports of irregular cycles since the lack of menstruation is hardly a woman's greatest burden and could even be viewed as beneficial, especially compared to the added burden of seeking medical attention.

It should also be noted that within each age range, amenorrhea was the highest reported menstrual cycle disorder. This is contrary to common belief that a higher frequency of the population likely has oligomenorrhea (i.e., infrequent cycles, but still menstruating) than amenorrhea (i.e., absence of menstruation for months at a time). This perhaps raises questions

about the diagnosis or terminology used by medical professionals in the diagnosis of menstrual disorders. In addition, females with oligomenorrhea may be slipping through the cracks in the medical system and are rarely receiving follow-up or a diagnosis of any kind, unless their issues reach the level of amenorrhea.

Due to the enormous amount of data in this study and some issues with poorly worded questions addressed earlier, we limited the next set of analysis to individuals that self-identified as competitive athletes only. Among these athletes, the percentage of respondents that reported regular cycling actually increased in the first 2 age groups. We could not look at the older age groups due to a low N. The percentage of these that experienced less than 10 menstrual cycles per year (amenorrhea or oligomenorrhea) was 29.6% at the high school age, 35.4% at the college age, and 46.2% at the post-college age. These values correspond to current literature reporting the prevalence of amenorrhea and oligomenorrhea in different athletic populations anywhere between 12% in cycling and swimming (Sanborn et al., 1982) to 79% in ballet (Abraham et al., 1982).

The average range of hours of physical activity performed by competitive athletes during the high school age was 10.6 +/- 3.54 (n=78), during the college age was 14.5 +/- 4.70 (n=48), and during the post-college age was 3.4 +/- 6.53 (n=13). Respondents reporting 0-3 menstrual cycles per year had the highest reported average physical activity hours per week (12.00 +/- 2.45). This aligns with current literature that lower energy availability from greater hours of physical activity may cause hormone deficiencies (Reed, 2008). In college, there was a small distinction between the average physical activity hours performed by those with regular cycles and those with irregular cycles, however, the relation was not linear and we did not control for the intensity of activity, so further analysis should be done on the sport being played and intensity performed (Dusek, 2001).

While the percentage of competitive athletes that reported irregular cycles within this study is high, the percentage within the total population was even higher within some age ranges. When analyzing the frequency of menstrual cycle disorder diagnosis by self-identified athlete status (Table 9), in no age range do competitive athletes constitute the majority of diagnosis. This could

be attributed to competitive athletes finding the lack of menstruation as a greater benefit to their sport than a concern for potential health consequences, especially given the lack of public knowledge regarding the existence of potential health consequences related to menstrual dysfunction. Additionally, this statistic may reflect that more menstrual irregularities are commonplace in the general population given the overweight/obesity epidemic (i.e., polycystic ovary syndrome) or it is also possible that more females are participating in recreational sports, restricting food intake and are actually less educated about these issues than competitive athletes. Thus, they may be more prone to menstrual irregularities. While low energy availability is often attributed to intense athletic participation, it is possible that other factors may be contributing to low energy availability within the general population (such as diet culture, recreational fitness, etc.) that is not being accounted for within current literature (Singh, 1981). It is also possible that participants of the HeRS that had experienced menstrual irregularities at some point felt more inclined to respond to both timepoints of the HeRS, and thus skewed our values.

5.6 Change of Physical Activity Levels and Characteristics of the Menstrual Cycle

During the high school age when the menstrual cycle is most irregular, nearly a third of all respondents (30.6%) had noticeable changes to their menstrual cycle characteristics (i.e., intensity, frequency, and duration) when they increased their physical activity level. This number decreased during the college age years (18-24: 12.5%), but then surprisingly increased again to 29.6% during the post-college years (18.24; n=114). The number of respondents that reported noticeable changes to menstrual cycle characteristics attributed to a decrease in physical activity was much lower across all age ranges. Questions arise around the percentage of individuals that experienced a significant decrease in physical activity, as a significant decrease in PA may only be acknowledged due to a bad injury requiring significant recovery time or a long off season in which the individual got out of shape.

Overall, an increase in physical activity led to the reporting of decreased menstrual cycle frequency (22.2%), intensity (7.6%), and duration (7.6%). Meanwhile a decrease in physical activity reported increased frequency (8.3%), intensity (7.6%), and duration (4.2%). This aligns

with our hypothesis, following the implications that higher physical activity means subsequently lower energy availability that correlates with less physiological energy reserved for the reproductive system, evident by a reduction in menstrual cycle frequency, duration, and intensity (Beals, 2002; Chumlea, 2003; Dusek, 2001; Freedman, 2002; Lagowska & Kapczuk, 2016; Mountjoy, 2018). While current literature most often acknowledges the impact of physical activity level on frequency of menstrual cycle (i.e., amenorrhea, oligomenorrhea), there is much less research on the impacts of physical activity on duration and flow of menstrual cycle which could also be indicators of anovulation (Talmor, 2015).

5.7 Women Reporting the Use of Birth Control by Athletic Self-Identification

Out of all 144 respondents which took the HeRS at both timepoints, 86.11% reported the use of some form of birth control during their lifetime.

Results were largely mixed on whether athlete status – the self-reporting as a competitive athlete, recreational athlete, or non-athlete – played a role in the use of birth control. During the high school age years, recreational athletes were the highest subgroup reporting use of birth control, followed closely by non-athletes and then by competitive athletes. By the post-college age years, recreational athletes remained the largest group and had the highest percentage of birth control use (64%). The college age group had the highest percentages of birth control use across athlete type (comp=62.5%; rec=78.1%; non=78.1%). This would align with common literature that these years are often when women become increasingly sexually active (Martinez, 2015).

While competitive athletes showed a similar increase in percentage use of birth control from high school age to college age (33.3% to 62.5%), the number of competitive athletes during this time frame decreased significantly (from n=78 to n=48), meaning that the number of individuals that reported the use of birth control only increased by 4 (26/78 to 30/48). If we assume that the reported competitive athletes in college were also competitive athletes in high school, then we could presume that a majority of college competitive athletes began using birth control in high

school. The reason for this trend is unclear and further investigation should specifically address the reasons that competitive athletes use birth control.

Across age ranges and athlete self-identification types, oral contraceptives were the most widely used form of birth control, followed by non-oral contraceptive. Multiple forms of birth control were reported most often during the college age years, mostly in recreational athletes, implying that this time period was when women most often explored birth control options to find one that most suited their needs.

In summary, the HeRS has a range of recall reliabilities dependent on the questions of interest, with some questions having excellent recall reliability while others performed poorly. Further work with the HeRS should focus on removing repetitive questions that do not add significant information about reproductive history, clarifying wording of some questions to increase recall reliability and adding questions to clarify physical activity participation.

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APPENDIX A. THE HEALTH AND REPRODUCTIVE SURVEY (HeRS)

Confidential

Retrospective Reproductive History Survey

Instructions:

This survey focuses on questions related to your menstrual cycle beginning with your very first period through present day. We know that asking you to recall menstrual cycle details from 20+ years ago may be difficult, but please be as accurate as possible. This survey will take approximately 12-15 minutes to complete.

Informed Consent

UNIVERSITY OF NORTH CAROLINA AT GREENSBORO
CONSENT TO ACT AS A HUMAN PARTICIPANT

Project Title: Assessing reproductive health recall

Principal Investigator: Dr. Donna Duffy

What are some general things you should know about research studies?
You are being asked to take part in a research study. Your participation in the study is voluntary. You may choose not to join, or you may withdraw your consent to be in the study, for any reason, without penalty.

Research studies are designed to obtain new knowledge. This new information may help people in the future. There may not be any direct benefit to you for being in the research study. There also may be risks to being in research studies. If you choose not to be in the study or leave the study before it is done, it will not affect your relationship with the researcher or the University of North Carolina at Greensboro.
Details about this study are discussed in this consent form. It is important that you understand this information so that you can make an informed choice about being in this research study.

You will be given a copy of this consent form. If you have any questions about this study at any time, you should ask the researchers named in this consent form. Their contact information is below.

What is the study about?
This is a research project. Your participation is voluntary. The goal of this study is to determine how well women are able to recall and report their reproductive history.

Why are you asking me?
We are asking you to participate because you are biologically a female and are 18+ years of age.

What will you ask me to do if I agree to be in the study?
If you choose to participate in this study, you will be asked to complete a ~20 minute, online survey.

Is there any audio/video recording?
No.

What are the risks to me?
The Institutional Review Board at the University of North Carolina at Greensboro has determined that participation in this study poses minimal risk to participants. Some females may experience some embarrassment when completing the survey, but given that the survey is individual and anonymous, this study has minimal risk associate with it.

If you have questions, want more information or have suggestions, please contact Dr.Donna Duffy at 336-334-3025 or dmduffy@uncg.edu/

If you have any concerns about your rights, how you are being treated, concerns or complaints about this project or benefits or risks associated with being in this study please contact the Office of Research Integrity at UNCG toll-free at (855)-251-2351.

Are there any benefits to society as a result of me taking part in this research?
Overall, this study will help us better understand the recall process of women related to their reproductive health, which may help with better understanding how the menstrual cycle influences injury prevention and injury recovery.

Are there any benefits to me for taking part in this research study?
There are no direct benefits to participants in this study.

Will I get paid for being in the study? Will it cost me anything?

This is the first page of the survey.
The full survey can be accessed by clicking here.

APPENDIX B. SUBJECT DEMOGRAPHIC DESCRIPTIVES

AGE OF RESPONDENTS

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
What is your current age?	144	18	73	32.73	11.919
Valid N (listwise)	144				

What is your current age?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18	3	2.1	2.1	2.1
	19	1	.7	.7	2.8
	20	4	2.8	2.8	5.6
	21	3	2.1	2.1	7.6
	22	6	4.2	4.2	11.8
	23	8	5.6	5.6	17.4
	24	5	3.5	3.5	20.8
	25	11	7.6	7.6	28.5
	26	14	9.7	9.7	38.2
	27	6	4.2	4.2	42.4
	28	7	4.9	4.9	47.2
	29	10	6.9	6.9	54.2
	30	6	4.2	4.2	58.3
	31	8	5.6	5.6	63.9
	32	6	4.2	4.2	68.1
	33	1	.7	.7	68.8
	34	8	5.6	5.6	74.3
	35	1	.7	.7	75.0
	36	3	2.1	2.1	77.1
	37	1	.7	.7	77.8
	38	1	.7	.7	78.5
	41	2	1.4	1.4	79.9
	42	3	2.1	2.1	81.9
	43	3	2.1	2.1	84.0
	46	1	.7	.7	84.7
	47	3	2.1	2.1	86.8
	49	1	.7	.7	87.5
	50	1	.7	.7	88.2
	51	1	.7	.7	88.9
	52	1	.7	.7	89.6
	54	2	1.4	1.4	91.0
	55	1	.7	.7	91.7
	57	3	2.1	2.1	93.8
	59	2	1.4	1.4	95.1
	60	1	.7	.7	95.8
	61	1	.7	.7	96.5
	62	1	.7	.7	97.2
	63	2	1.4	1.4	98.6
	71	1	.7	.7	99.3
	73	1	.7	.7	100.0
	Total	144	100.0	100.0	

MENARCHE WITH/WITHOUT TREATMENT

Did you get your first period WITHOUT the use of female hormones (e.g. any form of birth control) or lifestyle changes (e.g.weight or exercise changes)?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	3	2.1	2.1	2.1
	Yes	141	97.9	97.9	100.0
	Total	144	100.0	100.0	

AGE AT MENARCHE

How old were you the first time you had your period?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	11 or younger	24	16.7	16.7	16.7
	12-15	110	76.4	76.4	93.1
	16 or older	10	6.9	6.9	100.0
	Total	144	100.0	100.0	

LENGTH OF FIRST MENSTRUAL CYCLE

How many days did your first period last for?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I do not know/I cannot remember	33	22.9	22.9	22.9
	Less than one day	2	1.4	1.4	24.3
	2-7 days	104	72.2	72.2	96.5
	More than 7 days	5	3.5	3.5	100.0
	Total	144	100.0	100.0	

TIME BETWEEN FIRST AND SECOND MENSTRUAL CYCLE

After your first period stopped, when did you get your next period?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I do not know/I cannot remember	17	11.8	11.8	11.8
	Within six months	118	81.9	81.9	93.8
	After six months	9	6.3	6.3	100.0
	Total	144	100.0	100.0	

AFTER SECOND PERIOD, DID YOUR MENSTRUAL CYCLE START TO OCCUR REGULARLY

After your second period, did your periods start to occur on a regular cycle (every 21 to 35 days)?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I do not know/I cannot remember	13	9.0	9.0	9.0
	No	40	27.8	27.8	36.8
	Yes	91	63.2	63.2	100.0
	Total	144	100.0	100.0	

MOTHER'S AGE AT MENARCHE

How old was your mother when she got her first period? If you do not know, please write I do not know.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	9	1	.7	1.6	1.6
	10	2	1.4	3.3	4.9
	11	4	2.8	6.6	11.5
	12	12	8.3	19.7	31.1
	13	1	.7	1.6	32.8
	13	16	11.1	26.2	59.0
	14	3	2.1	4.9	63.9
	14	15	10.4	24.6	88.5
	15	3	2.1	4.9	93.4
	16	2	1.4	3.3	96.7
	17	1	.7	1.6	98.4
	18	1	.7	1.6	100.0
	Total	61	42.4	100.0	
Missing	System	83	57.6		
Total		144	100.0		

RESPONDENT NUMBER OF SISTERS

How many sisters do you have?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 Sister	57	39.6	67.9	67.9
	2 Sisters	24	16.7	28.6	96.4
	3 Sisters	3	2.1	3.6	100.0
	Total	84	58.3	100.0	
Missing	System	60	41.7		
Total		144	100.0		

HAVE EVER USED BIRTH CONTROL/ EXPERIENCED SIDE EFFECTS FROM BIRTH CONTROL

Have you ever experienced any side effects from taking any form of birth control?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	46	31.9	31.9	31.9
	Yes	78	54.2	54.2	86.1
	I have never used any form of birth control	20	13.9	13.9	100.0
	Total	144	100.0	100.0	

PHYSICAL ACTIVITY LEVEL AT MENARCHE

Which of the following best describes your physical activity level at the time of your first period?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I was physically active	119	82.6	82.6	82.6
	I was not physically active	25	17.4	17.4	100.0
	Total	144	100.0	100.0	

PHYSICAL ACTIVITY HOURS AT MENARCHE

Around the time of your first period, how many hours per week were you physically active, on average?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I do not know/ I cannot remember	2	1.4	1.4	1.4
	Not physically active	25	17.4	17.4	18.8
	<5 hours	18	12.5	12.5	31.3
	5-10 hours	44	30.6	30.6	61.8
	11-15 hours	29	20.1	20.1	81.9
	16-20 hours	16	11.1	11.1	93.1
	>20 hours	10	6.9	6.9	100.0
	Total	144	100.0	100.0	

VALUE-REPORTED PHYSICAL ACTIVITY HOURS AT MENARCHE

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
activity_hrs_4mo	143	.00	30.00	8.4545	6.05431
Valid N (listwise)	143				

SELF-IDENTIFIED ATHLETE TYPE AT MENARCHE

TFP_ATHLETE_type

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Non-Athlete	49	34.0	34.0	34.0
	Competitive Athlete	60	41.7	41.7	75.7
	Recreational Athlete	35	24.3	24.3	100.0
	Total	144	100.0	100.0	

MENARCHE BMI

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
MENARCHE_BMI	97	12.86	36.56	20.1467	2.88366
Valid N (listwise)	97				

MENARCHE_BMI

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	12.86	1	.7	1.0	1.0
	14.07	1	.7	1.0	2.1
	14.16	1	.7	1.0	3.1
	15.43	1	.7	1.0	4.1
	15.56	1	.7	1.0	5.2
	15.78	1	.7	1.0	6.2
	16.62	1	.7	1.0	7.2
	17.00	1	.7	1.0	8.2
	17.23	1	.7	1.0	9.3
	17.54	1	.7	1.0	10.3
	17.57	1	.7	1.0	11.3
	17.73	1	.7	1.0	12.4
	17.94	1	.7	1.0	13.4
	17.96	1	.7	1.0	14.4
	18.02	1	.7	1.0	15.5
	18.16	1	.7	1.0	16.5
	18.24	1	.7	1.0	17.5
	18.30	3	2.1	3.1	20.6
	18.31	1	.7	1.0	21.6
	18.37	1	.7	1.0	22.7
	18.55	1	.7	1.0	23.7
	18.58	1	.7	1.0	24.7
	18.59	1	.7	1.0	25.8
	18.78	1	.7	1.0	26.8
	18.87	3	2.1	3.1	29.9
	19.09	1	.7	1.0	30.9
	19.15	1	.7	1.0	32.0
	19.21	1	.7	1.0	33.0
	19.36	1	.7	1.0	34.0
	19.37	3	2.1	3.1	37.1
	19.49	4	2.8	4.1	41.2
	19.53	1	.7	1.0	42.3
	19.55	2	1.4	2.1	44.3
	19.72	1	.7	1.0	45.4
	19.74	1	.7	1.0	46.4
	19.81	1	.7	1.0	47.4
	19.84	2	1.4	2.1	49.5
	19.96	4	2.8	4.1	53.6
	19.98	1	.7	1.0	54.6
	20.12	1	.7	1.0	55.7

	20.19	1	.7	1.0	56.7
	20.39	2	1.4	2.1	58.8
	20.42	1	.7	1.0	59.8
	20.58	2	1.4	2.1	61.9
	20.64	1	.7	1.0	62.9
	20.68	1	.7	1.0	63.9
	20.70	1	.7	1.0	64.9
	20.80	1	.7	1.0	66.0
	20.92	1	.7	1.0	67.0
	21.00	1	.7	1.0	68.0
	21.12	1	.7	1.0	69.1
	21.17	1	.7	1.0	70.1
	21.25	1	.7	1.0	71.1
	21.29	1	.7	1.0	72.2
	21.40	1	.7	1.0	73.2
	21.48	2	1.4	2.1	75.3
	21.60	2	1.4	2.1	77.3
	21.65	2	1.4	2.1	79.4
	21.76	2	1.4	2.1	81.4
	21.80	1	.7	1.0	82.5
	21.92	3	2.1	3.1	85.6
	22.15	1	.7	1.0	86.6
	22.39	1	.7	1.0	87.6
	22.45	1	.7	1.0	88.7
	22.61	1	.7	1.0	89.7
	22.67	1	.7	1.0	90.7
	23.42	1	.7	1.0	91.8
	23.55	1	.7	1.0	92.8
	24.02	2	1.4	2.1	94.8
	24.67	1	.7	1.0	95.9
	24.80	1	.7	1.0	96.9
	25.06	1	.7	1.0	97.9
	26.81	1	.7	1.0	99.0
	36.56	1	.7	1.0	100.0
	Total	97	67.4	100.0	
Missing	System	47	32.6		
Total		144	100.0		

HS AVERAGE PERIODS PER YEAR

Between the ages of 13 and 18, approximately how many periods did you have per year, on average?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-3	10	6.9	7.4	7.4
	4-6	15	10.4	11.0	18.4
	7-9	19	13.2	14.0	32.4
	10-12	82	56.9	60.3	92.6
	13 or more	8	5.6	5.9	98.5
	Other	2	1.4	1.5	100.0
	Total	136	94.4	100.0	
Missing	System	8	5.6		
Total		144	100.0		

HS PERIOD STOP

Between the ages of 13 and 18, did your periods ever stop for 2+ months without the use of a contraceptive means and/or in the absence of pregnancy?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	85	59.0	61.2	61.2
	Yes	53	36.8	38.1	99.3
	Other	1	.7	.7	100.0
	Total	139	96.5	100.0	
Missing	System	5	3.5		
Total		144	100.0		

HS EXPERIENCED CHANGE IN MENSTRUAL CYCLE DUE TO PHYSICAL ACTIVITY

Between the ages of 13 and 18, did your menstrual cycle change due to your sport/physical activity participation?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	88	61.1	68.8	68.8
	Yes	40	27.8	31.3	100.0
	Total	128	88.9	100.0	
Missing	System	16	11.1		
Total		144	100.0		

APPENDIX C. EXCLUDED QUESTIONS FROM RECALL RELIABILITYANALYSIS

REASON FOR EXCLUSION	SURVEY LABEL	SURVEY QUESTION
Provides no valuable information about reproductive health recall	age18, hsage_check, age18_check	Are you 18 years of age or older?
	sisters	Do you have any biological sisters?
Added at Timepoint4mo	compath_tfp compath_hs compath_college compath_pc	At the time of your first period/ between the ages of 13-18/ between the ages of 18-24/ between the ages of 25-40, were you a competitive athlete?
	compsport_tfp__1-compsport_tfp__14 compsport_hs__1-compsport_hs__14 compsport_college__1-compsport_college__14 compsport_pc__1-compsport_pc__14	In what sport(s) were you a competitive athlete? (choice=Soccer, Basketball, Volleyball, Tennis, Swimming, Lacrosse, Softball, Golf, Field Hockey, Cross Country, Gymnastics, Dance, Other)
	dayssport_tfp/hs/college/pc	How many days per week did you train (include time playing the sport, lifting weights, and doing fitness)?
	hrswksport_tfp/hs/college/pc	How many hours per week were you training for your sport (time spent playing on the field or in the gym, etc.)?
	hrswkextra_tfp/hs/college/pc	How many hours per week were you doing additional training, like lifting weights or extra fitness?
	recath_tfp/hs/college/pc	At the time of your first period, were you a recreational athlete?
	recdayshigh_tfp/hs/college/pc	How many days per week did you participate in high-intensity sport (running, weight lifting, HIIT training, etc.)?
	rechrshigh_tfp/hs/college/pc	How many hours per day did you participate in high-intensity sport?
	recdaysmod_tfp/hs/college/pc	How many days per week did you participate in moderate-intensity sport (jogging, recreational sport, etc.)?
	rechrsmod_tfp/hs/college/pc	How many hours per day did you participate in moderate-intensity sport?
	recdayslow_tfp/hs/college/pc	How many days per week did you participate in low-intensity sport (walking, yoga, tai chi, etc.)?
	rechrslow_tfp/hs/college/pc	How many hours per day did you participate in low-intensity sport?
Poor survey design (lack of specificity of the question and significant changes in height between ages 13-18 made respondent answers unreliable)	hs_height	Approximately how tall were you between the ages of 13 and 18? Please report in inches (exclude units). If you do not remember, please write I cannot remember.

Poor survey design (lack of question directionality made respondent answers unreliable)	hs_pa_change college_pa_change pc_pa_change	Between the ages of 13 and 18/ 18-24/ 25-40, did your menstrual cycle change due to your sport/physical activity participation?
Not enough respondents answered in affirmation to have recall reliability be of significance.	hs/college/pc_ameno_age	At what age were you diagnosed with amenorrhea?
	hs/college/pc _ameno_treat	Please describe the type of treatment you received for amenorrhea between the ages of 13 and 18/ 18-24/ 25-40.
	hs/college/pc _ameno_ongoing	Is amenorrhea still an ongoing issue for you?
	hs/college/pc _amen_resolve	When did your amenorrhea resolve? Please report the month and year in which it resolved to the best of your ability. If you do not remember, please write I cannot remember.
	hs/college/pc _oligo_age	At what age were you diagnosed with oligomenorrhea?
	hs/college/pc _oligo_treat	Please describe the type of treatment you received for oligomenorrhea between the ages of 13 and 18/ 18-24/ 25-40.
	hs/college/pc _oligo_ongoing	Is oligomenorrhea still an ongoing issue for you?
	hs/college/pc _oligo_resolve	When did your oligomenorrhea resolve? Please report the month and year in which it resolved to the best of your ability. If you do not remember, please write I cannot remember.
	hs/college/pc _meno_age	At what age were you diagnosed with menometrorrhagia?
	hs/college/pc _meno_treat	Please describe the type of treatment you received for menometrorrhagia between the ages of 13 and 18/ 18-24/ 25-40.
	hs/college/pc _meno_ongoing	Is menometrorrhagia still an ongoing issue for you?
	hs/college/pc _meno_resolve	When did your menometrorrhagia resolve? Please report the month and year in which it resolved to the best of your ability. If you do not remember, please write I cannot remember.
	hs/college/pc _poly_age	At what age were you diagnosed with polymenorrhea?
	hs/college/pc _poly_treat	Please describe the type of treatment you received for polymenorrhea between the ages of 13 and 18/ 18-24/ 25-40.
	hs/college/pc _poly_ongoing	Is polymenorrhea still an ongoing issue for you?
	hs/college/pc _poly_resolve	When did your polymenorrhea resolve? Please report the month and year in which it resolved to the best of your ability. If you do not remember, please write I cannot remember.
	hs/college/pc _metro_age	At what age were you diagnosed with metrorrhagia?
	hs/college/pc _metro_treat	Please describe the type of treatment you received for metrorrhagia between the ages of 13 and 18/ 18-24/ 25-40.

	hs/college/pc _metro_ongoing	Is metrorrhagia still an ongoing issue for you?
	hs/college/pc _metro_resolve	When did your metrorrhagia resolve? Please report the month and year in which it resolved to the best of your ability. If you do not remember, please write I cannot remember.
	hs/college/pc _triad_age	At what age were you diagnosed with the female athlete triad?
	hs/college/pc _triad_treat	Please describe the type of treatment you received for the female athlete triad between the ages of 13 and 18/ 18-24/ 25-40.
	hs/college/pc _triad_ongoing	Is the female athlete triad still an ongoing issue for you?
	hs/college/pc _triad_resolve	When did the female athlete triad resolve for you? Please report the month and year in which it resolved to the best of your ability. If you do not remember, please write I cannot remember.
	hs/college/pc _reds_age	At what age were you diagnosed with RED-S?
	hs/college/pc _reds_treat	Please describe the type of treatment you received for RED-S between the ages of 13 and 18/ 18-24/ 25-40.
	hs/college/pc _reds_ongoing	Is the RED-S still an ongoing issue for you?
	hs/college/pc _reds_resolve	When did RED-S resolve for you? Please report the month and year in which it resolved to the best of your ability. If you do not remember, please write I cannot remember.
	hs/college/pc _anorexia_age	At what age were you diagnosed with anorexia nervosa?
	hs/college/pc _anorexia_treat	Please describe the type of treatment you received for anorexia nervosa between the ages of 13 and 18/ 18-24/ 25-40.
	hs/college/pc _anorexia_ongoing	Is anorexia nervosa still an ongoing issue for you?
	hs/college/pc _anorexia_resolve	When did your anorexia nervosa resolve? Please report the month and year in which it resolved to the best of your ability. If you do not remember, please write I cannot remember.
	hs/college/pc _bulimia_age	At what age were you diagnosed with bulimia nervosa?
	hs/college/pc _bulimia_treat	Please describe the type of treatment you received for bulimia nervosa between the ages of 13 and 18/ 18-24/ 25-40.
	hs/college/pc _bulimia_ongoing	Is bulimia nervosa still an ongoing issue for you?
	hs/college/pc _bulimia_resolve	When did your bulimia nervosa resolve? Please report the month and year in which it resolved to the best of your ability. If you do not remember, please write I cannot remember.
	hs/college/pc _binge_age	At what age were you diagnosed with binge eating disorder?
	hs/college/pc _binge_treat	Please describe the type of treatment you received for binge eating disorder between the ages of 13 and 18/ 18-24/ 25-40.
	hs/college/pc _binge_ongoing	Is binge eating disorder still an ongoing issue for you?

	hs/college/pc _binge_resolve	When did your binge eating disorder resolve? Please report the month and year in which it resolved to the best of your ability. If you do not remember, please write I cannot remember.
	hs/college/pc _purge_age	At what age were you diagnosed with purging disorder?
	hs/college/pc _purge_treat	Please describe the type of treatment you received for purging disorder between the ages of 13 and 18/ 18-24/ 25-40.
	hs/college/pc _purge_ongoing	Is purging disorder still an ongoing issue for you?
	hs/college/pc _purge_resolve	When did your purging disorder resolve? Please report the month and year in which it resolved to the best of your ability. If you do not remember, please write I cannot remember.
	hs/college/pc _avoidant_age	At what age were you diagnosed with avoidant/restrictive food intake disorder?
	hs/college/pc _avoidant_treat	Please describe the type of treatment you received for avoidant/restrictive food intake disorder between the ages of 13 and 18/ 18-24/ 25-40.
	hs/college/pc _avoidant_ongoing	Is avoidant/restrictive food intake disorder still an ongoing issue for you?
	hs/college/pc _avoidant_resolve	When did your avoidant/restrictive food intake disorder resolve? Please report the month and year in which it resolved to the best of your ability. If you do not remember, please write I cannot remember.
	hs/college/pc _night_age	At what age were you diagnosed with night eating syndrome?
	hs/college/pc _night_treat	Please describe the type of treatment you received for night eating syndrome between the ages of 13 and 18/ 18-24/ 25-40.
	hs/college/pc _night_ongoing	Is night eating syndrome still an ongoing issue for you?
	hs/college/pc _night_resolve	When did your night eating syndrome resolve? Please report the month and year in which it resolved to the best of your ability. If you do not remember, please write I cannot remember.
	hs/college/pc _pica_age	At what age were you diagnosed with pica?
	hs/college/pc _pica_treat	Please describe the type of treatment you received for pica between the ages of 13 and 18/ 18-24/ 25-40.
	hs/college/pc _pica_ongoing	Is pica still an ongoing issue for you?
	hs/college/pc _pica_resolve	When did your pica resolve ? Please report the month and year in which it resolved to the best of your ability. If you do not remember, please write I cannot remember.
	hs/college/pc _rumination_age	At what age were you diagnosed with rumination syndrome?
	hs/college/pc _rumination_treat	Please describe the type of treatment you received for rumination syndrome between the ages of 13 and 18/ 18-24/ 25-40.
	hs/college/pc _rumination_ongoing	Is rumination syndrome still an ongoing issue for you?

	hs/college/pc _rumination_resolve	When did your rumination syndrome resolve? Please report the month and year in which it resolved to the best of your ability. If you do not remember, please write I cannot remember.
	hs/college/pc _diabulimia_age	At what age were you diagnosed with diabulimia?
	hs/college/pc _diabulimia_treat	Please describe the type of treatment you received for diabulimia between the ages of 13 and 18/ 18-24/ 25-40.
	h hs/college/pc _diabulimia_ongoing	Is diabulimia still an ongoing issue for you?
	hs/college/pc _diabulimia_resolve	When did your diabulimia resolve? Please report the month and year in which it resolved to the best of your ability. If you do not remember, please write I cannot remember.
To be analyzed in a future study	hs_estro	Please list the month/year you began taking an estrogen only pill, the dosage, and the month/year you stopped taking it. Please be as accurate as possible. If you do not remember, please write I cannot remember.
	hs/college/pc_estro_purpose___1-10 hs/college/pc _estro_purpose___99 hs/college/pc _estro_purpose_other	For what purpose(s) did you take an estrogen only pill between the ages of 13 and 18/ 18-24/ 25-40? Choose all that apply. (choice=Avoidance of pregnancy, Control/regulate menstrual cycles, Initiate menstrual cycles, Pain, Control heavy bleeding, Avoid bleeding , Avoid cycles (prevent ovulation, Reduce injury risks, Reduce other symptoms (e.g. acne), Other, I do not know/I cannot remember)
	hs/college/pc_prog_purpose___1-10 hs/college/pc _prog_purpose___99 hs/college/pc _prog_purpose_other	For what purpose(s) did you take an progesterone only pill between the ages of 13 and 18/ 18-24/ 25-40? Choose all that apply. (choice=Avoidance of pregnancy, Control/regulate menstrual cycles, Initiate menstrual cycles, Pain, Control heavy bleeding, Avoid bleeding , Avoid cycles (prevent ovulation, Reduce injury risks, Reduce other symptoms (e.g. acne), Other, I do not know/I cannot remember)
	hs/college/pc_combo_purpose___1-10 hs/college/pc _ combo _purpose___99 hs/college/pc _ combo _purpose_other	For what purpose(s) did you take an combined estrogen and progesterone pill between the ages of 13 and 18/ 18-24/ 25-40? Choose all that apply. (choice=Avoidance of pregnancy, Control/regulate menstrual cycles, Initiate menstrual cycles, Pain, Control heavy bleeding, Avoid bleeding , Avoid cycles (prevent ovulation, Reduce injury risks, Reduce other symptoms (e.g. acne), Other, I do not know/I cannot remember)
	hs/college/pc_extended_purpose___1-10 hs/college/pc _ extended _purpose___99 hs/college/pc _ extended _purpose_other	For what purpose(s) did you take an extended-cycle pill between the ages of 13 and 18/ 18-24/ 25-40? Choose all that apply. (choice=Avoidance of pregnancy, Control/regulate menstrual cycles, Initiate menstrual cycles, Pain, Control heavy bleeding, Avoid bleeding , Avoid cycles (prevent ovulation, Reduce injury risks, Reduce other symptoms (e.g. acne), Other, I do not know/I cannot remember)
	hs/college/pc_vring_purpose___1-10 hs/college/pc _ vring _purpose___99 hs/college/pc _ vring _purpose_other	For what purpose(s) did you take a vaginal ring between the ages of 13 and 18/ 18-24/ 25-40? Choose all that apply. (choice=Avoidance of pregnancy, Control/regulate menstrual cycles,

		Initiate menstrual cycles, Pain, Control heavy bleeding, Avoid bleeding , Avoid cycles (prevent ovulation, Reduce injury risks, Reduce other symptoms (e.g. acne), Other, I do not know/I cannot remember)
	hs/college/pc_iud_purpose___1-10 hs/college/pc _ iud _purpose___99 hs/college/pc _ iud _purpose_other	For what purpose(s) did you take an IUD between the ages of 13 and 18/ 18-24/ 25-40? Choose all that apply. (choice=Avoidance of pregnancy, Control/regulate menstrual cycles, Initiate menstrual cycles, Pain, Control heavy bleeding, Avoid bleeding , Avoid cycles (prevent ovulation, Reduce injury risks, Reduce other symptoms (e.g. acne), Other, I do not know/I cannot remember)
	hs/college/pc_patch_purpose___1-10 hs/college/pc _ patch _purpose___99 hs/college/pc _ patch _purpose_other	For what purpose(s) did you take an estrogen patch between the ages of 13 and 18/ 18-24/ 25-40? Choose all that apply. (choice=Avoidance of pregnancy, Control/regulate menstrual cycles, Initiate menstrual cycles, Pain, Control heavy bleeding, Avoid bleeding , Avoid cycles (prevent ovulation, Reduce injury risks, Reduce other symptoms (e.g. acne), Other, I do not know/I cannot remember)
	hs/college/pc_implant_purpose___1-10 hs/college/pc _ implant _purpose___99 hs/college/pc _ implant _purpose_other	For what purpose(s) did you take an implant between the ages of 13 and 18/ 18-24/ 25-40? Choose all that apply. (choice=Avoidance of pregnancy, Control/regulate menstrual cycles, Initiate menstrual cycles, Pain, Control heavy bleeding, Avoid bleeding , Avoid cycles (prevent ovulation, Reduce injury risks, Reduce other symptoms (e.g. acne), Other, I do not know/I cannot remember)
	hs/college/pc_other_purpose___1-10 hs/college/pc _ other _purpose___99 hs/college/pc_other _purpose_other	For what purpose(s) did you use the other form(s) of birth control between the ages of 13 and 18/ 18-24/ 25-40? Choose all that apply. (choice=Avoidance of pregnancy, Control/regulate menstrual cycles, Initiate menstrual cycles, Pain, Control heavy bleeding, Avoid bleeding , Avoid cycles (prevent ovulation, Reduce injury risks, Reduce other symptoms (e.g. acne), Other, I do not know/I cannot remember)
	hs/college/pc _pregnancy	Between the ages of 13 and 18/ 18-24/ 25-40 were you ever pregnant?
	hs/college/pc _preg_number	How many times did you become pregnant between the ages of 13 and 18/ 18-24/ 25-40?
	hs/college/pc _preg_years	Please list each pregnancy that occurred between the ages of 13 and 18/ 18-24/ 25-40 by the year in which you became pregnant (e.g. Pregnancy 1 (1985)).
	hs/college/pc _preg1-5	First-fifth Pregnancy
	hs/college/pc _1-5preg_type	Was the first-fifth pregnancy between the ages of 13 and 18 / 18-24/ 25-40 naturally occurring or though IVF?
	hs/college/pc _1-5preg_term	Was your first-fifth pregnancy between the ages of 13 and 18/ 18-24/ 25-40 carried to full term (39 or more weeks)?

APPENDIX D. HeRS RECALL RELIABILITY FREQUENCY TABLE RESULTS

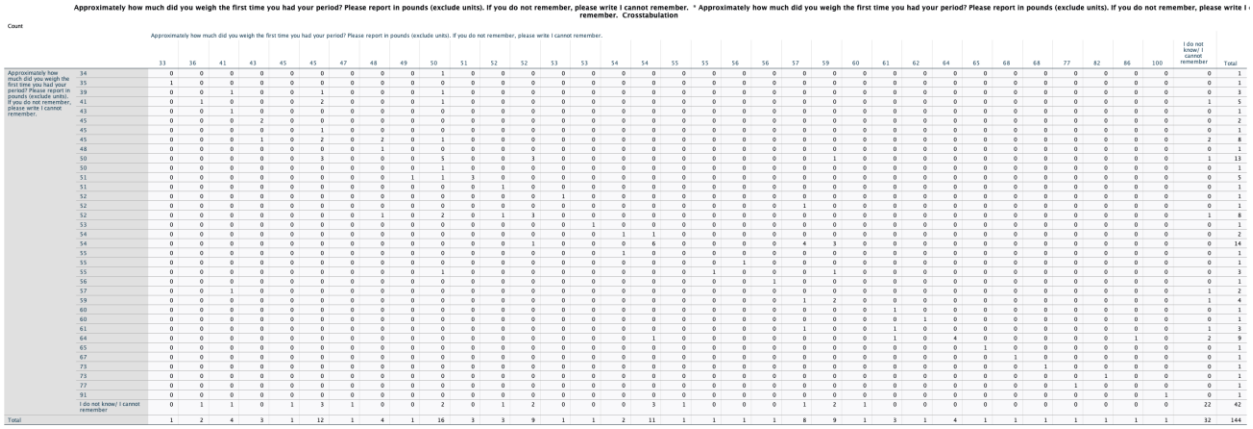
AGE AT FIRST PERIOD

How old were you the first time you had your period? * How old were you the first time you had your period? Crosstabulation

Count

		How old were you the first time you had your period?			
		11 or younger	12-15	16 or older	Total
How old were you the first time you had your period?	11 or younger	19	5	0	24
	12-15	1	107	2	110
	16 or older	0	1	9	10
Total		20	113	11	144

WEIGHT



Approximately how much did you weigh the first time you had your period? Please report in pounds (exclude units). If you do not remember, please write I cannot remember. * Approximately how much did you weigh the first time you had your period? Please report in pounds (exclude units). If you do not remember, please write I cannot remember. Crosstabulation

Count

| | | Approximately how much did you weigh the first time you had your period? Please report in pounds (exclude units). If you do not remember, please write I cannot remember. | | |

DAYS OF FIRST PERIOD

How many days did your first period last for? * How many days did your first period last for? Crosstabulation

Count

		How many days did your first period last for?				
		I do not know/I cannot remember	Less than one day	2-7 days	More than 7 days	Total
How many days did your first period last for?	I do not know/I cannot remember	20	0	13	0	33
	Less than one day	0	2	0	0	2
	2-7 days	12	1	89	2	104
	More than 7 days	0	0	0	5	5
Total		32	3	102	7	144

TIME AT SECOND PERIOD

After your first period stopped, when did you get your next period? * After your first period stopped, when did you get your next period? Crosstabulation

Count

		After your first period stopped, when did you get your next period?			
		I do not know/I cannot remember	Within six months	After six months	Total
After your first period stopped, when did you get your next period?	I do not know/I cannot remember	6	11	0	17
	Within six months	5	111	2	118
	After six months	1	4	4	9
Total		12	126	6	144

PERIOD REGULARITY

After your second period, did your periods start to occur on a regular cycle (every 21 to 35 days)? * After your second period, did your periods start to occur on a regular cycle (every 21 to 35 days)? Crosstabulation

Count

		After your second period, did your periods start to occur on a regular cycle (every 21 to 35 days)?			
		I do not know/I cannot remember	No	Yes	Total
After your second period, did your periods start to occur on a regular cycle (every 21 to 35 days)?	I do not know/I cannot remember	5	1	7	13
	No	1	30	9	40
	Yes	8	6	77	91
Total		14	37	93	144

MOTHER'S AGE AT MENARCHE

How old was your mother when she got her first period? If you do not know, please write I do not know. * How old was your mother when she got her first period? If you do not know, please write I do not know. Crosstabulation

Count

		How old was your mother when she got her first period? If you do not know, please write I do not know.									
		10	11	12	13	14	15	16	17	18	Total
How old was your mother when she got her first period? If you do not know, please write I do not know.	9	0	1	0	0	0	0	0	0	0	1
	10	1	0	0	0	0	0	0	0	0	1
	11	0	3	0	0	0	0	0	0	0	3
	12	0	1	8	0	0	0	0	0	0	9
	13	0	0	1	0	0	0	0	0	0	1
	13	0	0	1	8	2	0	0	0	0	11
	14	0	0	0	1	0	0	0	0	0	1
	14	0	0	0	1	7	1	1	0	0	10
	15	0	0	0	0	1	1	0	0	0	2
	16	0	0	0	0	0	0	2	0	0	2
	17	0	0	0	0	0	0	0	1	0	1
	18	0	0	0	0	0	0	0	0	1	1
Total		1	5	10	10	10	2	3	1	1	43

SISTER 1'S AGE AT MENARCHE

Sister 1 * Sister 1 Crosstabulation

Count

		Sister 1					
		I do not know	11 or younger	12-15	16 or older	Never	Total
Sister 1	I do not know	11	0	2	0	0	13
	11 or younger	1	5	4	0	0	10
	12-15	2	0	50	2	1	55
	16 or older	0	0	0	4	0	4
	Never	0	0	0	0	1	1
Total		14	5	56	6	2	83

SISTER 2'S AGE AT MENARCHE

Sister 2 * Sister 2 Crosstabulation

Count

		Sister 2				
		I do not know	11 or younger	12-15	16 or older	Total
Sister 2	I do not know	2	0	2	0	4
	11 or younger	0	1	0	1	2
	12-15	1	0	16	1	18
	16 or older	0	0	2	0	2
	Never	0	0	1	0	1
Total		3	1	21	2	27

SISTER 3'S AGE AT MENARCHE

Sister 3 * Sister 3 Crosstabulation

Count

		Sister 3		
		I do not know	12-15	Total
Sister 3	I do not know	1	0	1
	12-15	1	1	2
Total		2	1	3

PHYSICAL ACTIVITY AT TIME OF FIRST PERIOD

Which of the following best describes your physical activity level at the time of your first period? * Which of the following best describes your physical activity level at the time of your first period? Crosstabulation

Count

		Which of the following best describes your physical activity level at the time of your first period?		
		I was physically active	I was not physically active	Total
Which of the following best describes your physical activity level at the time of your first period?	I was physically active	118	1	119
	I was not physically active	3	22	25
Total		121	23	144

HOURS PHYSICALLY ACTIVE

Around the time of your first period, how many hours per week were you physically active, on average? * Around the time of your first period, how many hours per week were you physically active, on average? Crosstabulation

Count

		Around the time of your first period, how many hours per week were you physically active, on average?								
			Not physically active	<5 hours	5-10 hours	11-15 hours	16-20 hours	>20 hours	I cannot remember	Total
Around the time of your first period, how many hours per week were you physically active, on average?	I do not know/ I cannot remember	2	0	0	0	0	0	0	0	2
	Not physically active	0	0	0	2	0	0	0	0	2
	<5 hours	0	13	8	3	0	0	0	1	25
	5-10 hours	0	1	7	7	2	0	0	1	18
	11-15 hours	0	0	10	31	2	1	0	0	44
	16-20 hours	0	0	0	11	11	5	1	1	29
	>20 hours	0	0	1	3	7	4	1	0	16
Total		0	0	2	1	2	4	1	0	10
		2	14	28	58	24	14	3	3	146

CHANGE IN PHYSICAL ACTIVITY

After your first period but before your next period, did your physical activity patterns CHANGE? * After your first period but before your next period, did your physical activity patterns CHANGE? Crosstabulation

Count

		After your first period but before your next period, did your physical activity patterns CHANGE?				
		I do not know/I cannot remember	My physical activity patterns stayed the same	My physical activity patterns increased	My physical activity patterns decreased	Total
After your first period but before your next period, did your physical activity patterns CHANGE?	I do not know/I cannot remember	4	6	0	0	10
	My physical activity patterns stayed the same	11	109	6	2	128
	My physical activity patterns increased	1	2	0	0	3
	My physical activity patterns decreased	1	2	0	0	3
Total		17	119	6	2	144

SIDE EFFECTS FROM BIRTH CONTROL

Have you ever experienced any side effects from taking any form of birth control? * Have you ever experienced any side effects from taking any form of birth control? Crosstabulation

Count

		Have you ever experienced any side effects from taking any form of birth control?			
		No	Yes	I have never used any form of birth control	Total
Have you ever experienced any side effects from taking any form of birth control?	No	38	7	1	46
	Yes	4	74	0	78
	I have never used any form of birth control	1	0	19	20
Total		43	81	20	144

SIDE EFFECTS categorized

What side effects have you experienced from taking birth control? * What side effects have you experienced from taking birth control? Crosstabulation

Count

		What side effects have you experienced from taking birth control?			
		No side effects	1-2 side effects	3+ side effects	Total
What side effects have you experienced from taking birth control?	No side effects	59	2	5	66
	1-2 side effects	4	14	8	26
	3+ side effects	0	7	45	52
Total		63	23	58	144

AGE BEGIN HIGH SCHOOL

At what age did you begin high school? * At what age did you begin high school? Crosstabulation

Count

		At what age did you begin high school?							
		10	11	12	13	14	15	16	Total
At what age did you begin high school?	10	2	1	0	1	0	0	0	4
	11	0	7	1	0	0	0	0	8
	12	0	2	8	0	0	0	0	10
	13	0	0	1	18	9	1	0	29
	14	0	0	0	8	59	2	0	69
	15	0	0	1	3	5	7	1	17
	16	0	0	0	1	1	2	2	6
	17	0	0	0	0	1	0	0	1
Total		2	10	11	31	75	12	3	144

AGE COMPLETE HIGH SCHOOL

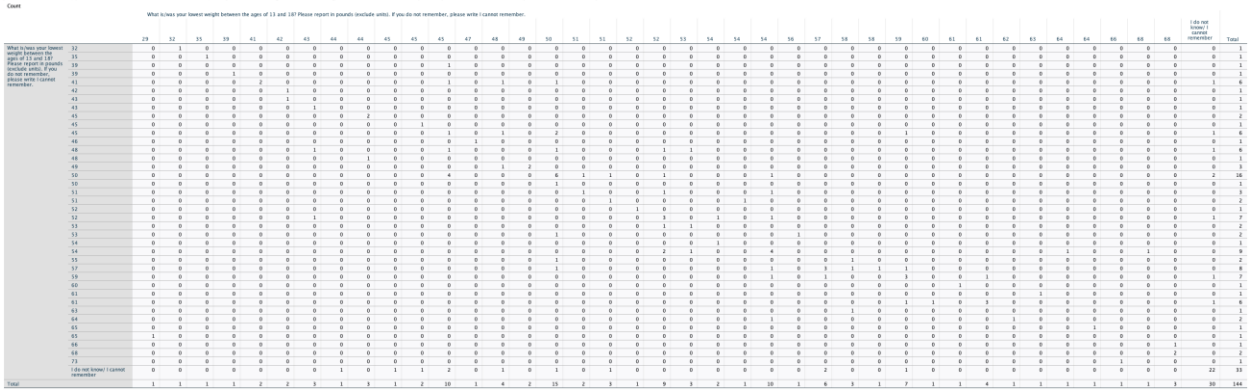
At what age did you end, complete, or graduate from high school? * At what age did you end, complete, or graduate from high school? Crosstabulation

Count

		At what age did you end, complete, or graduate from high school?						
		15	16	17	18	19	20	Total
At what age did you end, complete, or graduate from high school?	13	0	0	1	0	0	0	1
	15	2	0	0	0	0	0	2
	16	0	4	0	0	0	0	4
	17	0	2	38	4	0	0	44
	18	0	0	9	74	1	0	84
	19	0	0	0	4	3	0	7
	20	0	0	0	0	0	1	1
	21	0	0	1	0	0	0	1
Total		2	6	49	82	4	1	144

HS HIGH WEIGHT

HS LOW WEIGHT



HS HEIGHT

Approximately how tall were you between the ages of 13 and 18? Please report in inches (exclude units). If you do not remember, please write I cannot remember. * Approximately how tall were you between the ages of 13 and 18? Please report in inches (exclude units). If you do not remember, please write I cannot remember. Crosstabulation

Count

		Approximately how tall were you between the ages of 13 and 18? Please report in inches (exclude units). If you do not remember, please write I cannot remember.															
		152	154	155	157	160	163	165	166	168	170	173	175	178	180	I do not know/ I cannot remember	Total
Approximately how tall were you between the ages of 13 and 18? Please report in inches (exclude units). If you do not remember, please write I cannot remember.	147	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
	152	0	1	1	1	1	1	0	0	0	0	0	0	0	0	1	6
	155	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
	158	0	0	0	2	3	2	2	0	4	1	1	0	0	0	1	16
	160	0	1	0	2	1	3	3	0	1	1	0	0	1	1	1	15
	163	2	1	2	2	1	1	3	1	3	3	0	1	1	0	2	23
	165	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
	165	0	1	0	1	2	1	2	0	2	3	2	2	1	0	0	17
	167	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
	168	2	0	0	0	5	5	1	0	2	2	1	0	0	0	4	22
	170	0	0	1	3	2	2	2	0	2	3	1	0	1	0	2	19
	173	1	0	0	2	0	0	1	0	0	0	1	0	1	1	1	8
	175	0	0	0	1	0	0	0	0	4	0	1	0	0	0	0	6
	178	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	2
	180	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
	I do not know/ I cannot remember	0	0	0	0	0	2	1	0	0	0	0	1	0	0	0	4
Total		5	4	4	16	15	19	15	1	20	14	7	4	5	2	13	144

HS AVG NUMBER PERIODS

Between the ages of 13 and 18, approximately how many periods did you have per year, on average? * Between the ages o 13 and 18, approximately how many periods did you have per year, on average? Crosstabulation

Count

		Between the ages of 13 and 18, approximately how many periods did you have per year, on average?							
		I do not know/I cannot remember	0-3	4-6	7-9	10-12	13 or more	Other	Total
Between the ages of 13 and 18, approximately how many periods did you have per year, on average?	I do not know/I cannot remember	1	0	0	2	4	0	1	8
	0-3	0	6	4	0	0	0	0	10
	4-6	1	1	10	3	0	0	0	15
	7-9	2	1	3	7	5	0	1	19
	10-12	3	2	0	3	72	2	0	82
	13 or more	0	0	0	0	2	6	0	8
	Other	0	1	0	0	0	0	1	2
Total		7	11	17	15	83	8	3	144

HS PERIOD STOP

Between the ages of 13 and 18, did your periods ever stop for 2+ months without the use of a contraceptive means and/or in the absence of pregnancy? * Between the ages of 13 and 18, did your periods ever stop for 2+ months without the use of a contraceptive means and/or in the absence of pregnancy? Crosstabulation

Count

		Between the ages of 13 and 18, did your periods ever stop for 2+ months without the use of a contraceptive means and/or in the absence of pregnancy?			
		I do not know/I cannot remember	No	Yes	Total
Between the ages of 13 and 18, did your periods ever stop for 2+ months without the use of a contraceptive means and/or in the absence of pregnancy?	I do not know/I cannot remember	1	4	0	5
	No	1	81	3	85
	Yes	0	2	51	53
	Other	0	0	1	1
Total		2	87	55	144

HS AGE PERIOD STOPPED

Between the ages of 13 and 18, how old were you the first time your periods stopped for 2+ months without the use of a contraceptive means and/or in the absence of pregnancy? * Between the ages of 13 and 18, how old were you the first time your periods stopped for 2+ months without the use of a contraceptive means and/or in the absence of pregnancy? Crosstabulation

Count

		Between the ages of 13 and 18, how old were you the first time your periods stopped for 2+ months without the use of a contraceptive means and/or in the absence of pregnancy?						
		13	14	15	16	17	18	Total
Between the ages of 13 and 18, how old were you the first time your periods stopped for 2+ months without the use of a contraceptive means and/or in the absence of pregnancy?	13	5	3	0	1	0	0	9
	14	1	6	0	0	0	0	7
	15	0	2	5	3	0	0	10
	16	0	0	1	6	0	0	7
	17	0	1	0	2	5	0	8
	18	0	0	0	0	0	2	2
Total		6	12	6	12	5	2	43

HS MONTHS PERIOD STOPPED

Between the ages of 13 and 18, what was the longest length of time you went without a period without the use of a contraceptive means and/or in the absence of pregnancy? Ple report in months. * Between the ages of 13 and 18, what was the longest length of time you went without a period without the use of a contraceptive means and/or in the absenc pregnancy? Please report in months. Crosstabulation

Count

		Between the ages of 13 and 18, what was the longest length of time you went without a period without the use of a contraceptive means and/or in the absence of pregnancy? Please report in months.															
		2	3	5	6	7	8	9	10	12	13	24	36	43	48	60	Total
Between the ages of 13 and 18, what was the longest length of time you went without a period without the use of a contraceptive means and/or in the absence of pregnancy? Please report in months.	3	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	6
	4	0	2	0	3	0	0	0	0	0	0	0	0	0	0	0	5
	5	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
	6	0	0	0	5	1	0	0	0	0	1	0	0	0	0	0	7
	8	0	0	0	1	0	2	0	1	0	0	0	0	0	0	0	4
	9	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	3
	11	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
	12	0	0	0	1	0	1	0	0	3	0	1	0	0	0	0	6
	16	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
	22	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	24	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3
	36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
	38	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
	48	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	2
Total		1	7	1	11	1	4	1	1	5	1	6	2	1	1	1	44

HS PHYSICAL ACTIVITY CHANGE TO MENSTRUAL CYCLE

Between the ages of 13 and 18, did your menstrual cycle change due to your sport/physical activity participation? * Between the ages of 13 and 18, did your menstrual cycle change due to your sport/physical activity participation? Crosstabulation

Count

		Between the ages of 13 and 18, did your menstrual cycle change due to your sport/physical activity participation?			
		I do not know/I cannot remember	No	Yes	Total
Between the ages of 13 and 18, did your menstrual cycle change due to your sport/physical activity participation?	I do not know/I cannot remember	7	9	0	16
	No	6	79	3	88
	Yes	0	8	32	40
Total		13	96	35	144

HS PHYSICAL ACTIVITY CHANGE categorized

How did your menstrual cycle change between the ages of 13 and 18 due to your sport/physical activity participation? * How did your menstrual cycle change between the ages of 13 and 18 due to your sport/physical activity participation? Crosstabulation

Count

		How did your menstrual cycle change between the ages of 13 and 18 due to your sport/physical activity participation?			
		It did not change	Chose 1-2 answers	Chose 3+ answers	Total
How did your menstrual cycle change between the ages of 13 and 18 due to your sport/physical activity participation?	It did not change	100	2	1	103
	Chose 1-2 answers	6	21	1	28
	Chose 3+ answers	2	3	7	12
Total		108	26	9	143

HS INCREASED PHYSICAL ACTIVITY CHANGE TO MENSTRUAL CYCLE

Between the ages of 13 and 18, did your menstruation change when you INCREASED your physical activity? * Between the ages of 13 and 18, did your menstruation change when you INCREASED your physical activity? Crosstabulatio

Count

		Between the ages of 13 and 18, did your menstruation change when you INCREASED your physical activity?			
		I do not know/I cannot remember	No	Yes	Total
Between the ages of 13 and 18, did your menstruation change when you INCREASED your physical activity?	I do not know/I cannot remember	12	9	1	22
	No	8	67	3	78
	Yes	6	4	34	44
Total		26	80	38	144

HS INCREASED PHYSICAL ACTIVITY CHANGE TO MENSTRUAL CYCLE categorized

How did your menstrual cycle change when you INCREASED your physical activity between the ages of 13 and 18? * How did your menstrual cycle change when you INCREASED your physical activity between the ages of 13 and 18? Crosstabulation

Count

		How did your menstrual cycle change when you INCREASED your physical activity between the ages of 13 and 18?			
		It did not change	Chose 1-2 answers	Chose 3+ answers	Total
How did your menstrual cycle change when you INCREASED your physical activity between the ages of 13 and 18?	It did not change	96	4	0	100
	Chose 1-2 answers	9	27	3	39
	Chose 3+ answers	1	2	2	5
Total		106	33	5	144

HS DECREASED PHYSICAL ACTIVITY CAUSE CHANGE IN MENSTRUAL CYCLE

Between the ages of 13 and 18, did your menstruation change when you DECREASED your physical activity? * Between the ages of 13 and 18, did your menstruation change when you DECREASED your physical activity? Crosstabulation

Count

		Between the ages of 13 and 18, did your menstruation change when you DECREASED your physical activity?			
		I do not know/I cannot remember	No	Yes	Total
Between the ages of 13 and 18, did your menstruation change when you DECREASED your physical activity?	I do not know/I cannot remember	23	12	1	36
	No	11	74	5	90
	Yes	5	3	10	18
Total		39	89	16	144

HS DECREASED PA CHANGE TO MENSTRUAL CYCLE categorized

How did your menstrual cycle change when you DECREASED your physical activity between the ages of 13 and 18? * How did your menstrual cycle change when you DECREASED your physical activity between the ages of 13 and 18? Choose all that apply. Crosstabulation

Count

		How did your menstrual cycle change when you DECREASED your physical activity between the ages of 13 and 18? Choose all that apply.			
		It did not change	Chose 1–2 answers	2.00	Total
How did your menstrual cycle change when you DECREASED your physical activity between the ages of 13 and 18?	It did not change	119	5	1	125
	Chose 1–2 answers	7	5	2	14
	Chose 3+ answers	1	1	2	4
Total		127	11	5	143

HS MISSED TRAINING SESSION

Between the ages of 13 and 18, did you ever have to miss a training session or sport competition because of your menstrual cycle or related symptoms? * Between the ages of 13 and 18, did you ever have to miss a training session or sport competition because of your menstrual cycle or related symptoms? Crosstabulation

Count

		Between the ages of 13 and 18, did you ever have to miss a training session or sport competition because of your menstrual cycle or related symptoms?			
		I do not know/I cannot remember	No	Yes	Total
Between the ages of 13 and 18, did you ever have to miss a training session or sport competition because of your menstrual cycle or related symptoms?	I do not know/I cannot remember	2	1	0	3
	No	3	99	10	112
	Yes	2	9	18	29
Total		7	109	28	144

HS MISS PA categorized

Between the ages of 13 and 18, which symptoms prevented you from attending the training session or sport competition? * Between the ages of 13 and 18, which symptoms prevented you from attending the training session or sport competition? Crosstabulation

Count

		Between the ages of 13 and 18, which symptoms prevented you from attending the training session or sport competition?			
		No symptoms caused missed training	Chose 1–2 symptoms	Chose 3+ symptoms	Total
Between the ages of 13 and 18, which symptoms prevented you from attending the training session or sport competition?	No symptoms caused missed training	108	4	3	115
	Chose 1–2 symptoms	6	4	1	11
	Chose 3+ symptoms	6	3	9	18
Total		120	11	13	144

HS HIGH PERFORMANCE DURING CYCLE

Between the ages of 13 and 18, was there a point in your menstrual cycle when you could physically perform at a HIGHER level than your normal? * Between the ages of 13 and 18, was there a point in your menstrual cycle when you could physically perform at a HIGHER level than your normal? Crosstabulation

Count

		Between the ages of 13 and 18, was there a point in your menstrual cycle when you could physically perform at a HIGHER level than your normal?			
		I do not know/I cannot remember	No	Yes	Total
Between the ages of 13 and 18, was there a point in your menstrual cycle when you could physically perform at a HIGHER level than your normal?	I do not know/I cannot remember	32	25	2	59
	No	12	54	3	69
	Yes	3	5	8	16
Total		47	84	13	144

HS HIGH PERF values

Between the ages of 13 and 18, when during your menstrual cycle did you physically perform at a HIGHER level? * Between the ages of 13 and 18, when during your menstrual cycle did you physically perform at a HIGHER level? Crosstabulation

Count

		Between the ages of 13 and 18, when during your menstrual cycle did you physically perform at a HIGHER level?						
		At no time	At the beginning	In the middle	At the end	I do not know/ I cannot remember	At multiple times	Total
Between the ages of 13 and 18, when during your menstrual cycle did you physically perform at a HIGHER level?	At no time	123	0	1	3	1	0	128
	At the beginning	1	1	2	1	0	1	6
	In the middle	1	1	1	0	0	1	4
	At the end	1	0	0	0	0	0	1
	I do not know/ I cannot remember	2	0	0	0	0	0	2
	At multiple times	3	0	0	0	0	0	3
Total		131	2	4	4	1	2	144

HS LOW PERFORMANCE DURING CYCLE

Between the ages of 13 and 18, was there a point in your menstrual cycle when you physically performed at a LOWER level than your normal? * Between the ages of 13 and 18, was there a point in your menstrual cycle when you physically performed at a LOWER level than your normal? Crosstabulation

Count

		Between the ages of 13 and 18, was there a point in your menstrual cycle when you physically performed at a LOWER level than your normal?			
		I do not know/I cannot remember	No	Yes	Total
Between the ages of 13 and 18, was there a point in your menstrual cycle when you physically performed at a LOWER level than your normal?	I do not know/I cannot remember	28	11	6	45
	No	10	36	4	50
	Yes	5	15	29	49
Total		43	62	39	144

HS LOW PERFORMANCE values

When during your menstrual cycle did you physically perform at a LOWER level? * When during your menstrual cycle did you physically perform at a LOWER level? Crosstabulation

Count

		When during your menstrual cycle did you physically perform at a LOWER level?					
		At no time	At the beginning	In the middle	At the end	I do not know/ I cannot remember	Total
When during your menstrual cycle did you physically perform at a LOWER level?	At no time	85	8	0	1	1	95
	At the beginning	13	16	0	1	3	33
	In the middle	3	0	2	0	0	5
	At the end	1	1	0	1	0	3
	I do not know/ I cannot remember	2	3	0	0	0	5
	At multiple times	1	0	0	2	0	3
Total		105	28	2	5	4	144

MEDICAL CONDITIONS

Between the ages of 13 and 18, were you diagnosed with any of the following medical conditions? Choose all that apply. * Between the ages of 13 and 18, were you diagnosed with any of the following medical conditions? Choose all that apply. For each condition you select, you will be asked additional follow-up questions. (choice=None of the above) Crosstabulation

Count

		Between the ages of 13 and 18, were you diagnosed with any of the following medical conditions? Choose all that apply. For each condition you select, you will be asked additional follow-up questions. (choice=None of the above)										
		None	Amenorrhea	Oligomenorrhea	Menometrorrhagia	Polymenorrhea	The Female Athlete Triad	Anorexia Nervosa	Bulimia Nervosa	Other	Chose multiple answers	Total
Between the ages of 13 and 18, were you diagnosed with any of the following medical conditions? Choose all that apply.	None	101	3	1	1	1	0	0	0	1	0	108
	Amenorrhea	0	6	0	0	0	1	0	0	0	1	8
	Oligomenorrhea	0	0	1	0	0	0	0	0	0	0	1
	Polymenorrhea	0	0	0	0	0	0	0	0	0	1	1
	Anorexia Nervosa	0	1	0	0	0	0	1	0	0	0	2
	Bulimia Nervosa	0	0	0	0	0	0	0	1	0	0	1
	Avoidant/Restrictive Disorder	1	0	0	0	0	0	0	0	0	1	2
	Other	3	0	0	0	0	0	0	0	1	1	5
	Chose multiple answers	1	2	0	0	0	0	0	0	0	13	16
Total		106	12	2	1	1	1	1	1	2	17	144

HS BIRTH CONTROL USE

Between the ages of 13 and 18, did you use any form of birth control (not including condom use)? * Between the ages of 13 and 18, did you use any form of birth control (not including condom use)? Crosstabulation

Count

		Between the ages of 13 and 18, did you use any form of birth control (not including condom use)?		
		No	Yes	Total
Between the ages of 13 and 18, did you use any form of birth control (not including condom use)?	No	81	2	83
	Yes	5	56	61
Total		86	58	144

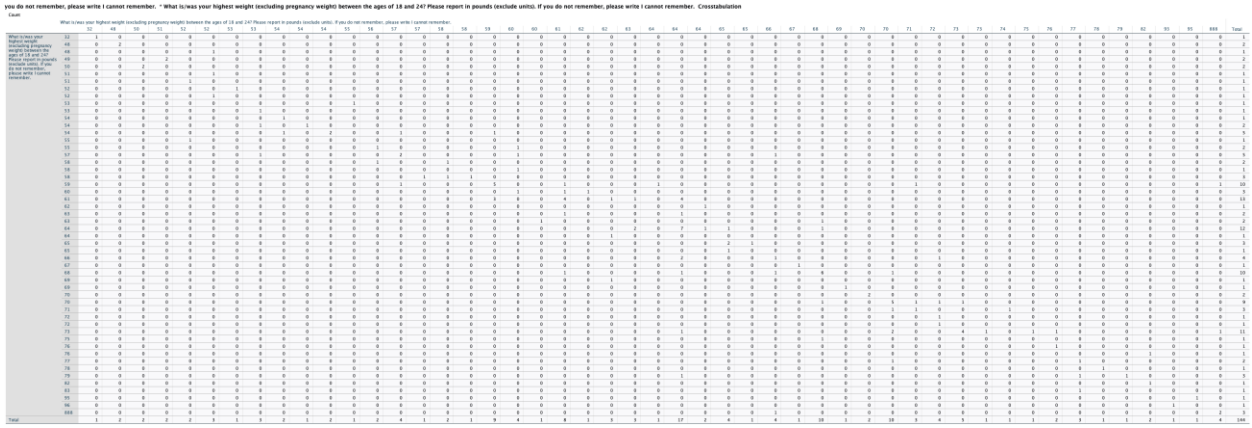
HS BIRTH CONTROL TYPES values

What form(s) of birth control did you use between the ages of 13 and 18? Choose all that apply. * What form(s) of birth control did you use between the ages of 13 and 18? Choose all that apply. Crosstabulation

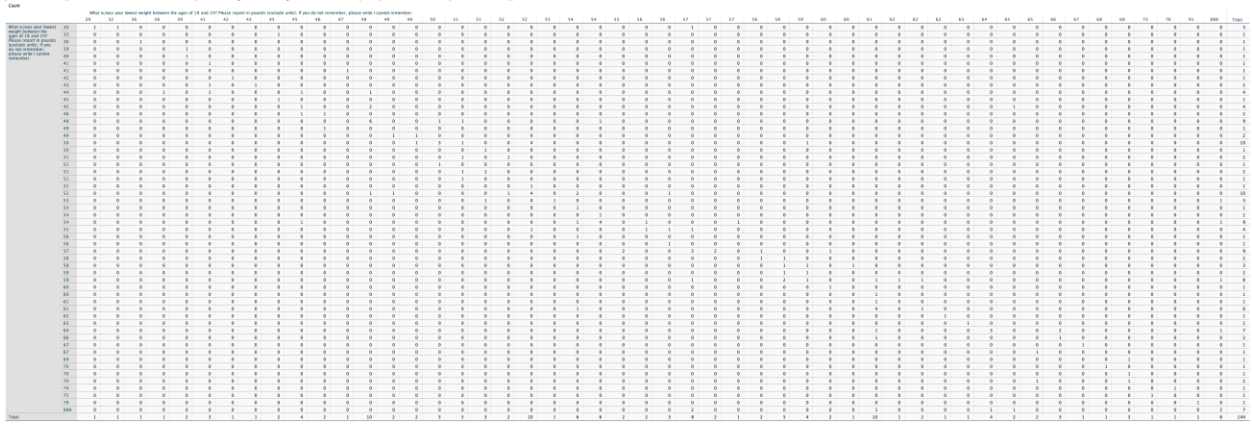
Count

		What form(s) of birth control did you use between the ages of 13 and 18? Choose all that apply.						
		.00	Oral contraceptive	Non-oral contraceptive	Other	I do not know/ I cannot remember	Multiple types of BC	Total
What form(s) of birth control did you use between the ages of 13 and 18? Choose all that apply.	.00	82	2	0	0	1	0	85
	Oral contraceptive	3	43	0	0	1	1	48
	Non-oral contraceptive	0	0	1	0	0	0	1
	Other	1	0	0	1	0	0	2
	I do not know/ I cannot remember	1	2	0	0	1	0	4
	Multiple types of BC	0	2	1	0	0	1	4
Total		87	49	2	1	3	2	144

COLLEGE HIGH WEIGHT



COLLEGE LOW WEIGHT



COLLEGE HEIGHT

Approximately how tall were you between the ages of 18 and 24? Please report in inches (exclude units). If you do not remember, please write I cannot remember. * Approximately how tall were you between the ages of 18 and 24? Please report in inches (exclude units). If you do not remember, please write I cannot remember. Crosstabulation

Count

		Approximately how tall were you between the ages of 18 and 24? Please report in inches (exclude units). If you do not remember, please write I cannot remember.																				
		147	152	154	154	155	157	160	162	163	165	166	168	170	170	173	175	178	180	183	888	Total
Approximately how tall were you between the ages of 18 and 24? Please report in inches (exclude units). If you do not remember, please write I cannot remember.	147	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	152	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	4
	154	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	3
	154	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3
	155	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
	157	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	157	0	1	1	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	1	16
	160	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	160	0	0	0	0	0	0	8	1	2	0	0	0	0	0	0	0	0	0	0	0	11
	163	0	0	0	0	0	0	3	0	18	1	0	0	0	0	0	0	0	0	0	1	23
	163	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
	165	0	0	0	0	0	0	0	0	2	6	0	2	0	0	0	0	0	0	0	0	10
	168	0	0	0	0	0	0	0	0	0	2	1	16	0	4	0	0	0	0	0	1	24
	168	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
	170	0	0	0	0	0	0	0	0	0	1	0	0	0	15	1	0	0	0	0	0	17
	173	0	0	0	0	0	0	0	0	0	0	0	0	0	1	7	0	0	0	0	1	9
	175	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	7
	178	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
	180	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2
	183	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2
	999	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2
Total		1	4	4	1	4	15	11	1	23	11	1	20	1	20	9	8	3	2	1	4	144

COLLEGE PERIOD NUMBER

Between the ages of 18 and 24, approximately how many periods did you have per year, on average? * Between the ages of 18 and 24, approximately how many periods did you have per year, on average? Crosstabulation

Count

		Between the ages of 18 and 24, approximately how many periods did you have per year, on average?						
		I do not know/I cannot remember	0–3	4–6	7–9	10–12	13 or more	Total
Between the ages of 18 and 24, approximately how many periods did you have per year, on average?	I do not know/I cannot remember	2	1	0	0	1	0	4
	0–3	0	23	2	0	0	0	25
	4–6	0	6	3	2	2	0	13
	7–9	0	0	3	6	5	0	14
	10–12	3	1	3	4	68	5	84
	13 or more	0	0	0	0	2	2	4
Total		5	31	11	12	78	7	144

COLLEGE PERIOD STOP (yes/no)

Between the ages of 18 and 24, did your periods ever stop for 2+ months without the use of contraception and/or in the absence of pregnancy? * Between the ages of 18 and 24, did your periods ever stop for 2+ months without the use of contraception and/or in the absence of pregnancy? Crosstabulation

Count

		Between the ages of 18 and 24, did your periods ever stop for 2+ months without the use of contraception and/or in the absence of pregnancy?			
		I do not know/I cannot remember	No	Yes	Total
Between the ages of 18 and 24, did your periods ever stop for 2+ months without the use of contraception and/or in the absence of pregnancy?	I do not know/I cannot remember	1	2	1	4
	No	0	78	4	82
	Yes	2	5	51	58
Total		3	85	56	144

COLLEGE PERIOD STOP AGE

Between the ages of 18 and 24, how old were you the first time your periods stopped for 2+ months without the use of contraception and/or in the absence of pregnancy? * Between the ages of 18 and 24, how old were you the first time your periods stopped for 2+ months without the use of contraception and/or in the absence of pregnancy? Crosstabulation

Count

		Between the ages of 18 and 24, how old were you the first time your periods stopped for 2+ months without the use of contraception and/or in the absence of pregnancy?									
		14	17	18	19	20	21	22	23	24	Total
Between the ages of 18 and 24, how old were you the first time your periods stopped for 2+ months without the use of contraception and/or in the absence of pregnancy?	13	1	0	0	0	0	0	0	0	0	1
	16	0	0	1	0	0	0	0	0	0	1
	18	0	1	16	0	0	0	0	0	0	17
	19	0	0	2	4	0	0	0	0	0	6
	20	0	0	0	0	2	1	0	0	0	3
	21	0	0	1	0	2	2	1	0	0	6
	22	0	0	0	0	0	1	2	1	0	4
	23	0	0	0	0	0	0	0	2	1	3
	24	0	0	0	0	0	0	1	0	2	3
Total		1	1	20	4	4	4	4	3	3	44

COLLEGE PERIOD STOP LENGTH

Between the ages of 18 and 24, what was the longest length of time you went without a period without the use of contraception and/or in the absence of pregnancy? Plea report in months. * Between the ages of 18 and 24, what was the longest length of time you went without a period without the use of contraception and/or in the absence pregnancy? Please report in months. Crosstabulation

Count

		Between the ages of 18 and 24, what was the longest length of time you went without a period without the use of contraception and/or in the absence of pregnancy? Please report in months.															
		3	4	6	8	9	12	16	18	20	24	30	36	48	54	72	Total
Between the ages of 18 and 24, what was the longest length of time you went without a period without the use of contraception and/or in the absence of pregnancy? Please report in months.	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
	4	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3
	6	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	2
	8	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	2
	11	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	3
	12	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
	25	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
	36	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	48	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	50	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
	72	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
Total		3	1	2	1	1	1	2	1	1	1	1	1	1	1	1	19

COLLEGE PHYSICAL ACTIVITY CHANGE CAUSE CHANGE TO MENSTRUAL CYCLE (yes/no)

Between the ages of 18 and 24, did your menstrual cycle change due to your sport/physical activity participation? * Between the ages of 18 and 24, did your menstrual cycle change due to your sport/physical activity participation? Crosstabulation

Count

		Between the ages of 18 and 24, did your menstrual cycle change due to your sport/physical activity participation?			
		I do not know/I cannot remember	No	Yes	Total
Between the ages of 18 and 24, did your menstrual cycle change due to your sport/physical activity participation?	I do not know/I cannot remember	7	7	3	17
	No	4	66	7	77
	Yes	3	6	41	50
Total		14	79	51	144

COLLEGE PHYSICAL ACTIVITY CHANGE categorized (cycle changes)

How did your menstrual cycle change between the ages of 18 and 24 due to your sport/physical activity participation? * How did your menstrual cycle change between the ages of 18 and 24 due to your sport/physical activity participation? Crosstabulation

Count

		How did your menstrual cycle change between the ages of 18 and 24 due to your sport/physical activity participation?			
		.00	1.00	2.00	Total
How did your menstrual cycle change between the ages of 18 and 24 due to your sport/physical activity participation?	It did not change	84	9	1	94
	Chose 1-2 answers	9	28	0	37
	Chose 3+ answers	1	5	7	13
Total		94	42	8	144

COLLEGE PHYSICAL ACTIVITY INC > CHANGE TO MENSTRUAL CYCLE (yes/no)

Between the ages of 18 and 24, did your menstruation change when you INCREASED your physical activity? * Between the ages of 18 and 24, did your menstruation change when you INCREASED your physical activity? Crosstabulatio

Count

		Between the ages of 18 and 24, did your menstruation change when you INCREASED your physical activity?			
		I do not know/I cannot remember	No	Yes	Total
Between the ages of 18 and 24, did your menstruation change when you INCREASED your physical activity?	I do not know/I cannot remember	8	8	4	20
	No	10	64	5	79
	Yes	4	8	33	45
Total		22	80	42	144

COLLEGE PHYSICAL ACTIVITY INC categorized (cycle changes)

How did your menstrual cycle change when you INCREASED your physical activity between the ages of 18 and 24? * How did your menstrual cycle change when you INCREASED your physical activity between the ages of 18 and 24? Crosstabulation

Count

		How did your menstrual cycle change when you INCREASED your physical activity between the ages of 18 and 24?			
		It did not change	Chose 1-2 answers	Chose 3+ answers	Total
How did your menstrual cycle change when you INCREASED your physical activity between the ages of 18 and 24?	It did not change	90	6	3	99
	Chose 1-2 answers	9	20	4	33
	Chose 3+ answers	3	4	5	12
Total		102	30	12	144

COLLEGE PHYSICAL ACTIVITY DEC > CHANGE TO MENSTRUAL CYCLE (yes/no)

Between the ages of 18 and 24, did your menstruation change when you DECREASED your physical activity? * Between the ages of 18 and 24, did your menstruation change when you DECREASED your physical activity? Crosstabulation

Count

		Between the ages of 18 and 24, did your menstruation change when you DECREASED your physical activity?			
		I do not know/I cannot remember	No	Yes	Total
Between the ages of 18 and 24, did your menstruation change when you DECREASED your physical activity?	I do not know/I cannot remember	15	9	4	28
	No	14	68	9	91
	Yes	1	6	18	25
Total		30	83	31	144

COLLEGE PHYSICAL ACTIVITY DEC categorized (cycle chanes)

How did your menstrual cycle change when you DECREASED your physical activity between the ages of 18 and 24? * How did your menstrual cycle change when you DECREASED your physical activity between the ages of 18 and 24? Crosstabulation

Count

		How did your menstrual cycle change when you DECREASED your physical activity between the ages of 18 and 24?			
		It did not change	Chose 1-2 answers	Chose 3+ answers	Total
How did your menstrual cycle change when you DECREASED your physical activity between the ages of 18 and 24?	It did not change	106	12	1	119
	Chose 1-2 answers	6	11	4	21
	Chose 3+ answers	1	0	3	4
Total		113	23	8	144

COLLEGE MISSED TRAINING DUE TO MENSTRUAL CYCLE (yes/no)

Between the ages of 18 and 24, did you ever have to miss a training session or sport competition because of your menstrual cycle or related symptoms? * Between the ages of 18 and 24, did you ever have to miss a training session or sport competition because of your menstrual cycle or related symptoms? Crosstabulatio

Count

		Between the ages of 18 and 24, did you ever have to miss a training session or sport competition because of your menstrual cycle or related symptoms?			
		I do not know/I cannot remember	No	Yes	Total
Between the ages of 18 and 24, did you ever have to miss a training session or sport competition because of your menstrual cycle or related symptoms?	I do not know/I cannot remember	3	7	0	10
	No	4	114	5	123
	Yes	1	3	7	11
Total		8	124	12	144

COLLEGE MISSED TRAINING categorized (cycle symptoms)

Between the ages of 18 and 24, when during your menstrual cycle did you physically perform at a HIGHER level? * Between the ages of 18 and 24, when during your menstrual cycle did you physically perform at a HIGHER level? Crosstabulation

Count

		Between the ages of 18 and 24, when during your menstrual cycle did you physically perform at a HIGHER level?						
		At no time	At the beginning	In the middle	At the end	I do not know/I cannot remember	At multiple times	Total
Between the ages of 18 and 24, when during your menstrual cycle did you physically perform at a HIGHER level?	At no time	118	2	3	3	1	2	129
	At the beginning	1	2	1	0	0	0	4
	In the middle	4	0	1	0	0	1	6
	At the end	0	0	0	0	0	1	1
	I do not know/I cannot remember	0	1	0	0	0	0	1
	At multiple times	0	0	1	0	0	2	3
Total		123	5	6	3	1	6	144

COLLEGE HIGH PERFORMANCE DURING CYCLE? (yes/no)

Between the ages of 18 and 24, was there a point in your menstrual cycle when you could physically perform at a HIGHER level than your normal? * Between the ages of 18 and 24, was there a point in your menstrual cycle when you could physically perform at a HIGHER level than your normal? Crosstabulation

Count

		Between the ages of 18 and 24, was there a point in your menstrual cycle when you could physically perform at a HIGHER level than your normal?			
		I do not know/I cannot remember	No	Yes	Total
Between the ages of 18 and 24, was there a point in your menstrual cycle when you could physically perform at a HIGHER level than your normal?	I do not know/I cannot remember	13	20	5	38
	No	20	65	6	91
	Yes	1	4	10	15
Total		34	89	21	144

COLLEGE HIGH PERFORMANCE values (times during cycle)

Between the ages of 18 and 24, when during your menstrual cycle did you physically perform at a HIGHER level? * Between the ages of 18 and 24, when during your menstrual cycle did you physically perform at a HIGHER level? Crosstabulation

Count

		Between the ages of 18 and 24, when during your menstrual cycle did you physically perform at a HIGHER level?						
		At no time	At the beginning	In the middle	At the end	I do not know/I cannot remember	At multiple times	Total
Between the ages of 18 and 24, when during your menstrual cycle did you physically perform at a HIGHER level?	At no time	118	2	3	3	1	2	129
	At the beginning	1	2	1	0	0	0	4
	In the middle	4	0	1	0	0	1	6
	At the end	0	0	0	0	0	1	1
	I do not know/I cannot remember	0	1	0	0	0	0	1
	At multiple times	0	0	1	0	0	2	3
Total		123	5	6	3	1	6	144

COLLEGE LOW PERFORMANCE DURING CYCLE? (yes/no)

Between the ages of 18 and 24, was there a point in your menstrual cycle when you physically performed at a LOWER level than your normal? * Between the ages of 18 and 24, was there a point in your menstrual cycle when you physically performed at a LOWER level than your normal? Crosstabulation

Count

		Between the ages of 18 and 24, was there a point in your menstrual cycle when you physically performed at a LOWER level than your normal?			
		I do not know/I cannot remember	No	Yes	Total
Between the ages of 18 and 24, was there a point in your menstrual cycle when you physically performed at a LOWER level than your normal?	I do not know/I cannot remember	11	17	7	35
	No	19	44	8	71
	Yes	5	18	15	38
Total		35	79	30	144

COLLEGE LOW PERFORMANCE values (times during cycle)

Between the ages of 18 and 24, when during your menstrual cycle did you physically perform at a LOWER level? * When during your menstrual cycle did you physically perform at a LOWER level? Crosstabulation

Count

		When during your menstrual cycle did you physically perform at a LOWER level?						
		At no time	At the beginning	In the middle	At the end	I do not know/I cannot remember	At multiple times	Total
Between the ages of 18 and 24, when during your menstrual cycle did you physically perform at a LOWER level?	At no time	91	7	0	6	1	1	106
	At the beginning	13	8	1	0	0	0	22
	In the middle	2	0	1	0	0	0	3
	At the end	3	0	0	2	0	0	5
	I do not know/I cannot remember	2	0	0	1	0	0	3
	At multiple times	3	1	0	1	0	0	5
Total		114	16	2	10	1	1	144

COLLEGE MEDICAL CONDITION

Between the ages of 18 and 24, were you diagnosed with any of the following medical conditions? Choose all that apply. * Between the ages of 18 and 24, were you diagnosed with any of the following medical conditions? Choose all that apply. Crosstabulation

Count

		Between the ages of 18 and 24, were you diagnosed with any of the following medical conditions? Choose all that apply.											
		None	Amenorrhea	Oligomenorrhea	Menomentrorrhagia	Polymenorrhea	The Female Athlete Triad	Anorexia Nervosa	Binge Eating Disorder	Avoidant/Restrictive Disorder	Other	Chose multiple answers	Total
Between the ages of 18 and 24, were you diagnosed with any of the following medical conditions? Choose all that apply.	None	85	4	0	1	0	0	0	0	0	2	1	93
	Amenorrhea	1	8	0	0	0	0	0	1	0	1	6	17
	Oligomenorrhea	0	1	0	0	0	0	0	0	0	0	0	1
	Polymenorrhea	0	0	0	0	1	0	0	0	0	0	0	1
	The Female Athlete Triad	0	0	0	0	0	1	0	0	0	0	0	1
	Anorexia Nervosa	1	0	0	0	0	0	1	0	0	0	1	3
	Binge Eating Disorder	0	0	0	0	0	0	0	0	0	1	0	1
	Avoidant/Restrictive Disorder	1	0	0	0	0	0	0	0	1	0	0	2
	Other	3	0	0	0	0	0	0	0	0	2	0	5
	Chose multiple answers	0	3	1	0	0	0	0	0	0	0	16	20
Total		91	16	1	1	1	1	1	1	1	6	24	144

COLLEGE BIRTH CONTROL (yes/no)

Between the ages of 18 and 24, did you use any form of birth control (not including condom use)? * Between the ages of 18 and 24, did you use any form of birth control (not including condom use)? Crosstabulation

Count

		Between the ages of 18 and 24, did you use any form of birth control (not including condom use)?		
		No	Yes	Total
Between the ages of 18 and 24, did you use any form of birth control (not including condom use)?	No	35	4	39
	Yes	7	98	105
Total		42	102	144

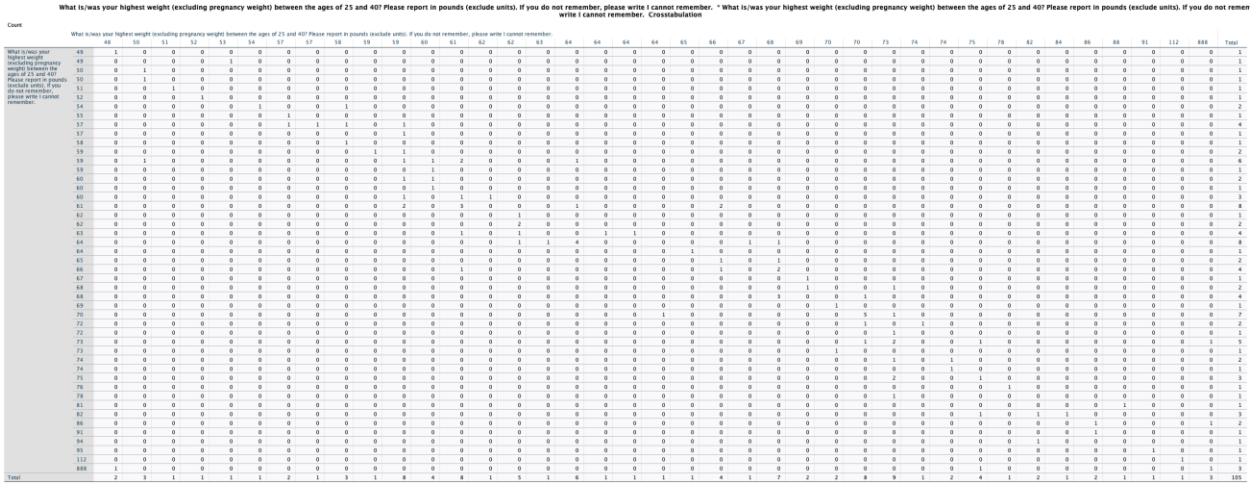
COLLEGE BIRTH CONTROL TYPE values

What form(s) of birth control did you use between the ages of 18 and 24? Choose all that apply. * 1-Oral contraceptive, 2-Non-or 3-Other, 4-Idk, 5-Oral cont and Non-oral, 6 - Combination of Other answers Crosstabulation

Count

		1-Oral contraceptive, 2-Non-oral, 3-Other, 4-Idk, 5-Oral cont and Non-oral, 6 - Combination of Other answers							
		.00	1.00	2.00	3.00	4.00	5.00	6.00	Total
What form(s) of birth control did you use between the ages of 18 and 24? Choose all that apply.	.00	35	2	0	1	1	0	0	39
	Oral contraceptive	7	62	0	1	5	0	0	75
	Non-oral contraceptive	0	0	4	0	0	2	0	6
	Other	0	0	1	0	0	0	0	1
	I do not know/I cannot remember	0	0	0	0	2	0	0	2
	Multiple types of BC	0	2	0	0	0	15	0	17
	6.00	0	0	0	0	1	1	2	4
Total		42	66	5	2	9	18	2	144

POST-COLLEGE HIGH WEIGHT

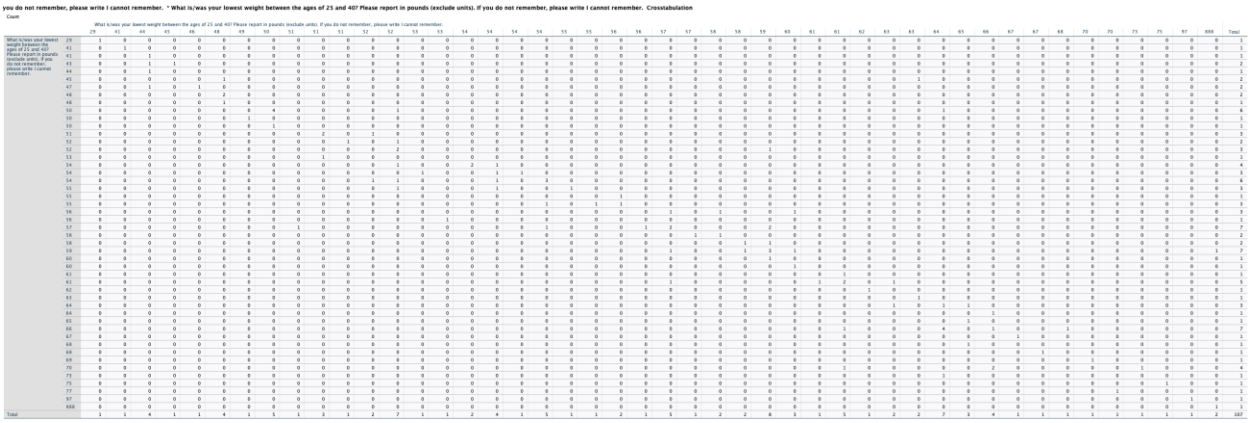


What is/was your highest weight (excluding pregnancy weight) between the ages of 25 and 40? Please report in pounds (exclude units). If you do not remember, please write I cannot remember. * What is/was your highest weight (excluding pregnancy weight) between the ages of 25 and 40? Please report in pounds (exclude units). If you do not remember, please write I cannot remember. Crosstabulation

Count

What is/was your highest weight (excluding pregnancy weight) between the ages of 25 and 40? Please report in pounds (exclude units). If you do not remember, please write I cannot remember.		48	50	51	52	53	54	57	57	58	59	59	60	61	62	62	63	64	64	64	64	65	66	67	68	69	70	70	73	74	74	75	78	82	84	86	88	91	112	888	Total
What is/was your highest weight (excluding pregnancy weight) between the ages of 25 and 40? Please report in pounds (exclude units). If you do not remember, please write I cannot remember.	48	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	49	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	50	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	51	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	52	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	54	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	55	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	57	0	0	0	0	0	0	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
	57	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	58	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	59	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	59	0	1	0	0	0	0	0	0	0	0	1	1	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
	59	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	60	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	60	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	60	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	61	0	0	0	0	0	0	0	0	0	0	0	0	2	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
	62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	63	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
	64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	4	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
	64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	66	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
	67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
	68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	4
	69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	7
	72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	2
	72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	1	0	0	0	0	0	0	0	5
	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
	74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	2
	74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	3
	76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
	81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
	82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	3
	86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	2
	91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
	94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
	112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
	888	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	3
Total		2	3	1	1	1	1	2	1	3	1	8	4	8	1	5	1	6	1	1	1	1	4	1	7	2	2	8	9	1	2	4	1	2	1	2	1	1	3	105

POST-COLLEGE LOW WEIGHT



you do not remember, please write I cannot remember. * What is/was your lowest weight between the ages of 25 and 40? Please report in pounds (exclude units). If you do not remember, please write I cannot remember. Crosstabulation

Count

What is/was your lowest weight between the ages of 25 and 40? Please report in pounds (exclude units). If you do not remember, please write I cannot remember.		29	41	44	45	46	48	49	50	51	51	51	52	52	53	53	54	54	54	54	55	55	56	56	57	57	58	58	59	60	61	61	62	63	63	64	65	66	67	67	68	70	70	73	75	97	888	Total
What is/was your lowest weight between the ages of 25 and 40? Please report in pounds (exclude units). If you do not remember, please write I cannot remember.	29	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	41	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	41	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	43	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	44	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	45	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	47	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	48	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	48	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	50	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	51	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	52	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	53	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	54	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
	54	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	55	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

POST-COLLEGE PERIOD NUMBER

Between the ages of 25 and 40, approximately how many periods did you have per year, on average? * Between the ages of 25 and 40, approximately how many periods did you have per year, on average? Crosstabulation

Count

		Between the ages of 25 and 40, approximately how many periods did you have per year, on average?						
		I do not know/I cannot remember	0–3	4–6	7–9	10–12	13 or more	Total
Between the ages of 25 and 40, approximately how many periods did you have per year, on average?	I do not know/I cannot remember	1	0	0	0	0	0	1
	0–3	0	22	3	3	3	0	31
	4–6	0	2	3	5	1	0	11
	7–9	0	1	0	3	3	0	7
	10–12	1	2	2	5	42	2	54
	13 or more	0	0	0	0	1	2	3
Total		2	27	8	16	50	4	107

POST-COLLEGE PERIOD STOP (yes/no)

Between the ages of 25 and 40, did your periods ever stop for 2+ months without the use of contraception and/or in the absence of pregnancy? * Between the ages of 25 and 40, did your periods ever stop for 2+ months without the use of contraception and/or in the absence of pregnancy? Crosstabulation

Count

		Between the ages of 25 and 40, did your periods ever stop for 2+ months without the use of contraception and/or in the absence of pregnancy?			
		I do not know/I cannot remember	No	Yes	Total
Between the ages of 25 and 40, did your periods ever stop for 2+ months without the use of contraception and/or in the absence of pregnancy?	I do not know/I cannot remember	0	2	0	2
	No	1	52	0	53
	Yes	0	4	48	52
Total		1	58	48	107

POST-COLLEGE PERIOD STOP AGE

Between the ages of 25 and 40, how old were you the first time your periods stopped for 2+ months without the use of contraception and/or in the absence pregnancy? * Between the ages of 25 and 40, how old were you the first time your periods stopped for 2+ months without the use of contraception and/or in absence of pregnancy? Crosstabulation

Count

		Between the ages of 25 and 40, how old were you the first time your periods stopped for 2+ months without the use of contraception and/or in the absence of pregnancy?														
		18	22	23	24	25	26	27	28	29	30	31	32	33	34	Total
Between the ages of 25 and 40, how old were you the first time your periods stopped for 2+ months without the use of contraception and/or in the absence of pregnancy?	22	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
	24	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
	25	1	0	1	0	15	1	0	0	0	0	0	0	0	0	18
	26	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3
	27	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2
	28	0	0	0	0	0	0	1	2	1	0	0	0	0	0	4
	29	0	0	0	0	0	0	0	1	0	1	0	0	0	0	2
	30	0	0	0	0	0	0	0	0	1	2	1	0	0	0	4
	31	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
	32	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
	34	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Total		1	1	1	1	15	5	2	3	2	3	1	1	2	1	39

POST-COLLEGE PERIOD STOP LENGTH

Between the ages of 25 and 40, what was the longest length of time you went without a period without the use of contraception and/or in the absence of pregnancy? Pleas report in months. * Between the ages of 25 and 40, what was the longest length of time you went without a period without the use of contraception and/or in the absence c pregnancy? Please report in months. Crosstabulation

Count

		Between the ages of 25 and 40, what was the longest length of time you went without a period without the use of contraception and/or in the absence of pregnancy? Please report in months.																	
		3	4	6	7	9	12	14	24	27	32	36	40	41	46	60	66	72	Total
Between the ages of 25 and 40, what was the longest length of time you went without a period without the use of contraception and/or in the absence of pregnancy? Please report in months.	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	6	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	8	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
	9	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
	11	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	12	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	4
	20	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	24	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
	26	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
	36	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
	38	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	48	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2
	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
	65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
	72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Total		2	1	2	1	2	3	2	1	1	1	1	1	1	1	1	1	1	23

POST-COLLEGE PHYSICAL ACTIVITY CHANGE CAUSE CHANGE TO MENSTRUAL CYCLE (yes/no)

Between the ages of 25 and 40, did your menstrual cycle change due to your sport/physical activity participation? * Between the ages of 25 and 40, did your menstrual cycle change due to your sport/physical activity participation? Crosstabulation

Count

		Between the ages of 25 and 40, did your menstrual cycle change due to your sport/physical activity participation?			
		I do not know/I cannot remember	No	Yes	Total
Between the ages of 25 and 40, did your menstrual cycle change due to your sport/physical activity participation?	I do not know/I cannot remember	4	1	1	6
	No	9	47	6	62
	Yes	2	7	30	39
Total		15	55	37	107

POST-COLLEGE PHYSICAL ACTIVITY CHANGE categorized (cycle changes)

How did your menstrual cycle change between the ages of 25 and 40 due to your sport/physical activity participation? * How did your menstrual cycle change between the ages of 25 and 40 due to your sport/physical activity participation? Crosstabulation

Count

		How did your menstrual cycle change between the ages of 25 and 40 due to your sport/physical activity participation?			
		It did not change	Chose 1-2 answers	Chose 3+ answers	Total
How did your menstrual cycle change between the ages of 25 and 40 due to your sport/physical activity participation?	It did not change	69	5	2	76
	Chose 1-2 answers	8	20	1	29
	Chose 3+ answers	1	4	4	9
Total		78	29	7	114

POST-COLLEGE PHYSICAL ACTIVITY INC > CHANGE TO MENSTRUAL CYCLE (yes/no)

Between the ages of 25 and 40, did your menstruation change when you INCREASED your physical activity? * Between the ages of 25 and 40, did your menstruation change when you INCREASED your physical activity? Crosstabulatio

Count

		Between the ages of 25 and 40, did your menstruation change when you INCREASED your physical activity?			
		I do not know/I cannot remember	No	Yes	Total
Between the ages of 25 and 40, did your menstruation change when you INCREASED your physical activity?	I do not know/I cannot remember	6	3	2	11
	No	4	54	6	64
	Yes	0	3	29	32
Total		10	60	37	107

POST-COLLEGE PHYSICAL ACTIVITY INC categorized (cycle changes)

How did your menstrual cycle change when you INCREASED your physical activity between the ages of 25 and 40? * How did your menstrual cycle change when you INCREASED your physical activity between the ages of 25 and 40? Crosstabulation

Count

		How did your menstrual cycle change when you INCREASED your physical activity between the ages of 25 and 40?			
		It did not change	Chose 1-2 answers	Chose 3+ answers	Total
How did your menstrual cycle change when you INCREASED your physical activity between the ages of 25 and 40?	They did not change	74	5	3	82
	Chose 1-2 answers	3	18	3	24
	Chose 3+ answers	0	4	4	8
Total		77	27	10	114

POST-COLLEGE PHYSICAL ACTIVITY DEC > CHANGE TO MENSTRUAL CYCLE (yes/no)

How did your menstrual cycle change when you DECREASED your physical activity between the ages of 25 and 40? * How did your menstrual cycle change when you DECREASED your physical activity between the ages of 25 and 40? Crosstabulation

Count

		How did your menstrual cycle change when you DECREASED your physical activity between the ages of 25 and 40?			
		It did not change	Chose 1-2 answers	Chose 3+ answers	Total
How did your menstrual cycle change when you DECREASED your physical activity between the ages of 25 and 40?	It did not change	78	13	2	93
	Chose 1-2 answers	4	15	0	19
	Chose 3+ answers	0	0	2	2
Total		82	28	4	114

POST-COLLEGE PHYSICAL ACTIVITY DEC categorized (cycle changes)

How did your menstrual cycle change when you DECREASED your physical activity between the ages of 25 and 40? * How did your menstrual cycle change when you DECREASED your physical activity between the ages of 25 and 40? Crosstabulation

Count

		How did your menstrual cycle change when you DECREASED your physical activity between the ages of 25 and 40?			
		It did not change	Chose 1-2 answers	Chose 3+ answers	Total
How did your menstrual cycle change when you DECREASED your physical activity between the ages of 25 and 40?	It did not change	108	13	2	123
	Chose 1-2 answers	4	15	0	19
	Chose 3+ answers	0	0	2	2
Total		112	28	4	144

POST-COLLEGE MISSED TRAINING DUE TO MENSTRUAL CYCLE (yes/no)

Between the ages of 25 and 40, did you ever have to miss a training session or sport competition because of your menstrual cycle or related symptoms? * Between the ages of 25 and 40, did you ever have to miss a training session or sport competition because of your menstrual cycle or related symptoms? Crosstabulatio

Count

		Between the ages of 25 and 40, did you ever have to miss a training session or sport competition because of your menstrual cycle or related symptoms?			
		I do not know/I cannot remember	No	Yes	Total
Between the ages of 25 and 40, did you ever have to miss a training session or sport competition because of your menstrual cycle or related symptoms?	I do not know/I cannot remember	0	4	0	4
	No	3	87	2	92
	Yes	0	3	8	11
Total		3	94	10	107

POST-COLLEGE MISSED TRAINING categorized (cycle symptoms)

Between the ages of 25 and 40, which symptoms prevented you from attending the training session or sport competition? * Between the ages of 25 and 40, which symptoms prevented you from attending the training session or sport competition Crosstabulation

Count

		Between the ages of 25 and 40, which symptoms prevented you from attending the training session or sport competition?			
		No symptoms caused missed training	Chose 1–2 symptoms	Chose 3+ symptoms	Total
Between the ages of 25 and 40, which symptoms prevented you from attending the training session or sport competition?	No symptoms caused missed training	101	1	1	103
	Chose 1–2 symptoms	0	1	0	1
	Chose 3+ symptoms	3	1	6	10
Total		104	3	7	114

POST-COLLEGE HIGH PERFORMANCE DURING CYCLE? (yes/no)

Between the ages of 25 and 40, was there a point in your menstrual cycle when you could physically perform at a HIGHER level than your normal? * Between the ages of 25 and 40, was there a point in your menstrual cycle when you could physically perform at a HIGHER level than your normal? Crosstabulation

Count

		Between the ages of 25 and 40, was there a point in your menstrual cycle when you could physically perform at a HIGHER level than your normal?			
		I do not know/I cannot remember	No	Yes	Total
Between the ages of 25 and 40, was there a point in your menstrual cycle when you could physically perform at a HIGHER level than your normal?	I do not know/I cannot remember	5	9	2	16
	No	13	61	2	76
	Yes	1	2	12	15
Total		19	72	16	107

POST-COLLEGE HIGH PERFORMANCE values (times during cycle)

Between the ages of 25 and 40, when during your menstrual cycle did you physically perform at a HIGHER level? * Between the ages of 25 and 40, when during your menstrual cycle did you physically perform at a HIGHER level? Crosstabulation

Count

		Between the ages of 25 and 40, when during your menstrual cycle did you physically perform at a HIGHER level?				
		At the beginning	In the middle	At the end	At multiple times	Total
Between the ages of 25 and 40, when during your menstrual cycle did you physically perform at a HIGHER level?	At no time	0	1	2	1	4
	At the beginning	2	0	1	0	3
	In the middle	0	4	0	0	4
	I do not know/I cannot remember	1	0	1	0	2
	At multiple times	0	0	0	3	3
Total		3	5	4	4	16

POST-COLLEGE LOW PERFORMANCE DURING CYCLE? (yes/no)

Between the ages of 25 and 40, was there a point in your menstrual cycle when you physically performed at a LOWER level than your normal? * Between the ages of 25 and 40, was there a point in your menstrual cycle when you physically performed at a LOWER level than your normal? Crosstabulation

Count

		Between the ages of 25 and 40, was there a point in your menstrual cycle when you physically performed at a LOWER level than your normal?			
		I do not know/I cannot remember	No	Yes	Total
Between the ages of 25 and 40, was there a point in your menstrual cycle when you physically performed at a LOWER level than your normal?	I do not know/I cannot remember	5	7	2	14
	No	13	50	3	66
	Yes	3	4	20	27
Total		21	61	25	107

POST-COLLEGE LOW PERFORMANCE values (times during cycle)

Between the ages of 25 and 40, when during your menstrual cycle did you physically perform at a LOWER level? * Between the ages of 25 and 40, when during your menstrual cycle did you physically perform at a LOWER level? Crosstabulation

Count

		Between the ages of 25 and 40, when during your menstrual cycle did you physically perform at a LOWER level?					
		At no time	At the beginning	In the middle	At the end	At multiple times	Total
Between the ages of 25 and 40, when during your menstrual cycle did you physically perform at a LOWER level?	At no time	82	3	1	1	0	87
	At the beginning	4	7	0	0	0	11
	In the middle	0	0	0	0	2	2
	At the end	1	2	0	6	0	9
	I do not know/I cannot remember	0	0	0	1	0	1
	At multiple times	2	0	0	2	0	4
Total		89	12	1	10	2	114

POST-COLLEGE MEDICAL CONDITION

Between the ages of 25 and 40, were you diagnosed with any of the following medical conditions? Choose all that apply. * Between the ages of 25 and 40, were you diagnosed with any of the following medical conditions? Choose al that apply. Crosstabulation

Count

		Between the ages of 25 and 40, were you diagnosed with any of the following medical conditions? Choose all that apply.						
		None	Amenorrhea	Menomentrorrhagia	Other	Chose multiple answers	999.00	Total
Between the ages of 25 and 40, were you diagnosed with any of the following medical conditions? Choose all that apply.	None	57	3	0	2	2	1	65
	Amenorrhea	1	19	0	0	5	0	25
	Menomentrorrhagia	1	0	1	0	0	0	2
	Binge Eating Disorder	0	0	0	0	1	0	1
	Other	0	0	0	1	0	0	1
	Chose multiple answers	1	2	0	1	10	0	14
	999.00	6	0	0	0	0	0	6
Total		66	24	1	4	18	1	114

POST-COLLEGE BIRTH CONTROL (yes/no)

Between the ages of 25 and 40, did you use any form of birth control (not including condom use)? * Between the ages of 25 and 40, did you use any form of birth control (not including condom use)? Crosstabulation

Count

		Between the ages of 25 and 40, did you use any form of birth control (not including condom use)?		
		No	Yes	Total
Between the ages of 25 and 40, did you use any form of birth control (not including condom use)?	No	34	10	44
	Yes	2	61	63
Total		36	71	107

POST-COLLEGE BIRTH CONTROL TYPE values

What form(s) of birth control did you use between the ages of 25 and 40? Choose all that apply. * What form(s) of birt control did you use between the ages of 25 and 40? Choose all that apply. Crosstabulation

Count

		What form(s) of birth control did you use between the ages of 25 and 40? Choose all that apply.						
		.00	Oral contraceptive	Non-oral contraceptive	Other	I do not know/I cannot remember	Multiple forms of bc	Total
What form(s) of birth control did you use between the ages of 25 and 40? Choose all that apply.	.00	35	8	3	1	1	3	51
	Oral contraceptive	1	33	1	1	1	2	39
	Non-oral contraceptive	1	2	11	0	0	2	16
	I do not know/I cannot remember	0	0	0	0	1	0	1
	Multiple forms of bc	1	1	1	0	0	4	7
Total		38	44	16	2	3	11	114

APPENDIX E. RECALL RELIABILITY OF MENARCHE BE CURRENT AGE FREQUENCY TABLE RESULTS

RECALL OF AGE AT MENARCHE **BY RESPONDENT CURRENT AGE**

How old were you the first time you had your period? * How old were you the first time you had your period? Crosstabulation

Count

AGE_GROUP			How old were you the first time you had your period? 11 or younger	12–15	16 or older	Total
1.00	How old were you the first time you had your period?	11 or younger	5	0	0	5
		12–15	1	22	0	23
		16 or older	0	1	1	2
	Total		6	23	1	30
2.00	How old were you the first time you had your period?	11 or younger	6	3	0	9
		12–15	0	32	2	34
		16 or older	0	0	5	5
	Total		6	35	7	48
3.00	How old were you the first time you had your period?	11 or younger	3	0	0	3
		12–15	0	24	0	24
		16 or older	0	0	2	2
	Total		3	24	2	29
4.00	How old were you the first time you had your period?	11 or younger	5	2	0	7
		12–15	0	29	0	29
		16 or older	0	0	1	1
	Total		5	31	1	37

Symmetric Measures

AGE_GROUP			Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
1.00	Measure of Agreement	Kappa	.823	.120	5.419	.000
	N of Valid Cases		30			
2.00	Measure of Agreement	Kappa	.766	.099	7.127	.000
	N of Valid Cases		48			
3.00	Measure of Agreement	Kappa	1.000	.000	6.921	.000
	N of Valid Cases		29			
4.00	Measure of Agreement	Kappa	.829	.116	5.794	.000
	N of Valid Cases		37			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

WEIGHT AT MENARCHE **BY RESPONDENT CURRENT AGE**

Descriptive Statistics

AGE_GROUP		N	Minimum	Maximum	Mean	Std. Deviation
1.00	Delta_weight	29	-4.57	11.30	1.0019	3.72201
	Valid N (listwise)	29				
2.00	Delta_weight	37	-9.07	9.07	.0021	3.12904
	Valid N (listwise)	37				
3.00	Delta_weight	23	-4.54	9.10	.4771	2.76315
	Valid N (listwise)	23				
4.00	Delta_weight	25	-15.88	22.68	1.1981	6.63367
	Valid N (listwise)	25				

HEIGHT AT MENARCHE **BY RESPONDENT CURRENT AGE**

Descriptive Statistics

AGE_GROUP		N	Minimum	Maximum	Mean	Std. Deviation
1.00	Delta_height	26	-5.10	5.10	.1327	2.78062
	Valid N (listwise)	26				
2.00	Delta_height	39	-5.04	20.32	.9774	4.01760
	Valid N (listwise)	39				
3.00	Delta_height	24	-7.60	5.12	.1133	3.21284
	Valid N (listwise)	24				
4.00	Delta_height	25	-7.60	5.04	.3032	2.23406
	Valid N (listwise)	25				

FIRST PERIOD LENGTH **BY RESPONDENT CURRENT AGE**

How many days did your first period last for? * How many days did your first period last for? Crosstabulation

Count

AGE_GROUP			How many days did your first period last for?				
			I do not know/I cannot remember	Less than one day	2-7 days	More than 7 days	Total
1.00	How many days did your first period last for?	I do not know/I cannot remember	1	0	3	0	4
		Less than one day	0	1	0	0	1
		2-7 days	2	0	22	0	24
		More than 7 days	0	0	0	1	1
	Total		3	1	25	1	30
2.00	How many days did your first period last for?	I do not know/I cannot remember	6	0	5	0	11
		2-7 days	2	1	29	2	34
		More than 7 days	0	0	0	3	3
	Total		8	1	34	5	48
3.00	How many days did your first period last for?	I do not know/I cannot remember	2	0	3		5
		Less than one day	0	1	0		1
		2-7 days	5	0	18		23
	Total		7	1	21		29
4.00	How many days did your first period last for?	I do not know/I cannot remember	11		2	0	13
		2-7 days	3		20	0	23
		More than 7 days	0		0	1	1
	Total		14		22	1	37

Symmetric Measures

AGE_GROUP			Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
1.00	Measure of Agreement	Kappa	.476	.206	3.513	.000
	N of Valid Cases		30			
2.00	Measure of Agreement	Kappa	.541	.127	4.945	.000
	N of Valid Cases		48			
3.00	Measure of Agreement	Kappa	.280	.202	1.743	.081
	N of Valid Cases		29			
4.00	Measure of Agreement	Kappa	.728	.114	4.799	.000
	N of Valid Cases		37			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

TIME UNTIL SECOND PERIOD **BY RESPONDENT CURRENT AGE**

After your first period stopped, when did you get your next period? * After your first period stopped, when did you get your next period? Crosstabulation

Count

AGE_GROUP			After your first period stopped, when did you get your next period?			
			I do not know/I cannot remember	Within six months	After six months	Total
1.00	After your first period stopped, when did you get your next period?	I do not know/I cannot remember	0	2	0	2
		Within six months	1	25	0	26
		After six months	0	1	1	2
	Total		1	28	1	30
2.00	After your first period stopped, when did you get your next period?	I do not know/I cannot remember	1	3	0	4
		Within six months	0	38	2	40
		After six months	1	1	2	4
	Total		2	42	4	48
3.00	After your first period stopped, when did you get your next period?	I do not know/I cannot remember	1	3		4
		Within six months	2	23		25
	Total		3	26		29
4.00	After your first period stopped, when did you get your next period?	I do not know/I cannot remember	4	3	0	7
		Within six months	2	25	0	27
		After six months	0	2	1	3
	Total		6	30	1	37

Symmetric Measures

AGE_GROUP			Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
1.00	Measure of Agreement	Kappa	.286	.255	2.154	.031
	N of Valid Cases		30			
2.00	Measure of Agreement	Kappa	.440	.162	4.004	.000
	N of Valid Cases		48			
3.00	Measure of Agreement	Kappa	.190	.241	1.037	.300
	N of Valid Cases		29			
4.00	Measure of Agreement	Kappa	.496	.162	3.734	.000
	N of Valid Cases		37			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

AFTER SECOND PERIOD DID CYCLE BECOME REGULAR **BY RESPONDENT CURRENT AGE**

After your second period, did your periods start to occur on a regular cycle (every 21 to 35 days)? * After your second period, did your periods start to occur on a regular cycle (every 21 to 35 days)? Crosstabulation

Count

AGE_GROUP			After your second period, did your periods start to occur on a regular cycle (every 21 to 35 days)?			
			I do not know/I cannot remember	No	Yes	Total
1.00	After your second period, did your periods start to occur on a regular cycle (every 21 to 35 days)?	I do not know/I cannot remember	2	0	1	3
		No	0	6	2	8
		Yes	0	2	17	19
	Total		2	8	20	30
2.00	After your second period, did your periods start to occur on a regular cycle (every 21 to 35 days)?	I do not know/I cannot remember	1	1	3	5
		No	0	16	4	20
		Yes	1	3	19	23
	Total		2	20	26	48
3.00	After your second period, did your periods start to occur on a regular cycle (every 21 to 35 days)?	I do not know/I cannot remember	0	0	2	2
		No	0	2	0	2
		Yes	3	0	22	25
	Total		3	2	24	29
4.00	After your second period, did your periods start to occur on a regular cycle (every 21 to 35 days)?	I do not know/I cannot remember	2	0	1	3
		No	1	6	3	10
		Yes	4	1	19	24
	Total		7	7	23	37

Symmetric Measures

AGE_GROUP			Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
1.00	Measure of Agreement	Kappa	.667	.137	4.535	.000
	N of Valid Cases		30			
2.00	Measure of Agreement	Kappa	.556	.105	4.630	.000
	N of Valid Cases		48			
3.00	Measure of Agreement	Kappa	.372	.226	2.623	.009
	N of Valid Cases		29			
4.00	Measure of Agreement	Kappa	.490	.130	4.078	.000
	N of Valid Cases		37			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

MOTHER'S AGE AT MENARCHE **BY RESPONDENT CURRENT AGE**

Descriptive Statistics

AGE_GROUP		N	Minimum	Maximum	Mean	Std. Deviation
1.00	Delta_mom_period	12	-1.00	.00	-.0833	.28868
	Valid N (listwise)	12				
2.00	Delta_mom_period	15	-1.00	1.00	.0333	.48058
	Valid N (listwise)	15				
3.00	Delta_mom_period	10	-1.00	2.00	.2000	.78881
	Valid N (listwise)	10				
4.00	Delta_mom_period	6	-1.00	2.00	.0833	1.02062
	Valid N (listwise)	6				

PHYSICAL ACTIVITY LEVEL AT MENARCHE **BY RESPONDENT CURRENT AGE**

Which of the following best describes your physical activity level at the time of your first period? * Which of the following best describes your physical activity level at the time of your first period? Crosstabulation

Count

AGE_GROUP			Which of the following best describes your physical activity level at the time of your first period?		Total
			I was physically active	I was not physically active	
1.00	Which of the following best describes your physical activity level at the time of your first period?	I was physically active	23	0	23
		I was not physically active	0	7	7
	Total		23	7	30
2.00	Which of the following best describes your physical activity level at the time of your first period?	I was physically active	41	1	42
		I was not physically active	2	4	6
	Total		43	5	48
3.00	Which of the following best describes your physical activity level at the time of your first period?	I was physically active	20	0	20
		I was not physically active	1	8	9
	Total		21	8	29
4.00	Which of the following best describes your physical activity level at the time of your first period?	I was physically active	34	0	34
		I was not physically active	0	3	3
	Total		34	3	37

Symmetric Measures

AGE_GROUP			Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
1.00	Measure of Agreement	Kappa	1.000	.000	5.477	.000
	N of Valid Cases		30			
2.00	Measure of Agreement	Kappa	.692	.166	4.822	.000
	N of Valid Cases		48			
3.00	Measure of Agreement	Kappa	.917	.081	4.955	.000
	N of Valid Cases		29			
4.00	Measure of Agreement	Kappa	1.000	.000	6.083	.000
	N of Valid Cases		37			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

HOURS PER WEEK PHYSICALLY ACTIVE **BY RESPONDENT CURRENT AGE**

Around the time of your first period, how many hours per week were you physically active, on average? * Around the time your first period, how many hours per week were you physically active, on average? Crosstabulation

Count

AGE_GROUP			Around the time of your first period, how many hours per week were you physically active, on average?						
			Not physically active	<5 hours	5–10 hours	11–15 hours	16–20 hours	>20 hours	Total
1.00	Around the time of your first period, how many hours per week were you physically active, on average?	Not physically active	2	5	0	0	0		7
		<5 hours	0	2	3	0	0		5
		5–10 hours	0	2	2	2	0		6
		11–15 hours	0	0	1	2	3		6
		16–20 hours	0	0	0	2	1		3
		>20 hours	0	2	0	0	1		3
	Total		2	11	6	6	5		30
2.00	Around the time of your first period, how many hours per week were you physically active, on average?	Not physically active	4	0	2	0	0		6
		<5 hours	1	1	1	1	0		4
		5–10 hours	0	4	12	0	1		17
		11–15 hours	0	0	7	3	2		12
		16–20 hours	0	1	2	2	2		7
		>20 hours	0	0	0	1	1		2
	Total		5	6	24	7	6		48
3.00	Around the time of your first period, how many hours per week were you physically active, on average?	I do not know/ I cannot remember	0	0	1	0			1
		Not physically active	4	3	1	0			8
		<5 hours	0	2	1	1			4
		5–10 hours	0	2	6	0			8
		11–15 hours	0	0	0	4			4
		16–20 hours	0	0	0	1			1
	Total		4	7	9	6			26
4.00	Around the time of your first period, how many hours per week were you physically active, on average?	I do not know/ I cannot remember	0	0	1	0	0	0	1
		Not physically active	3	0	0	0	0	0	3
		<5 hours	0	2	2	0	0	0	4
		5–10 hours	0	2	11	0	0	0	13
		11–15 hours	0	0	3	2	0	1	6
		16–20 hours	0	0	1	2	1	1	5
		>20 hours	0	0	1	1	2	1	5
	Total		3	4	19	5	3	3	37

Symmetric Measures

AGE_GROUP			Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
1.00	Measure of Agreement	Kappa	.153	.098	1.927	.054
	N of Valid Cases		30			
2.00	Measure of Agreement	Kappa	.273	.091	3.701	.000
	N of Valid Cases		48			
3.00	Measure of Agreement	Kappa	.500	.117	4.882	.000
	N of Valid Cases		26			
4.00	Measure of Agreement	Kappa	.393	.101	5.019	.000
	N of Valid Cases		37			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

PA CHANGE BETWEEN FIRST AND SECOND PERIOD **BY RESPONDENT CURRENT AGE**

After your first period but before your next period, did your physical activity patterns CHANGE? After your first period but before your next period, did your physical activity patterns CHANGE? Crosstabulation

Count

AGE_GROUP			After your first period but before your next period, did your physical activity patterns CHANGE?				
			I do not know/I cannot remember	My physical activity patterns stayed the same	My physical activity patterns increased	My physical activity patterns decreased	Total
1.00	After your first period but before your next period, did your physical activity patterns CHANGE?	I do not know/I cannot remember	0	2	0		2
		My physical activity patterns stayed the same	3	21	2		26
		My physical activity patterns increased	0	1	0		1
		My physical activity patterns decreased	1	0	0		1
	Total		4	24	2		30
2.00	After your first period but before your next period, did your physical activity patterns CHANGE?	I do not know/I cannot remember	1	2	0	0	3
		My physical activity patterns stayed the same	2	35	4	1	42
		My physical activity patterns increased	1	0	0	0	1
		My physical activity patterns decreased	0	2	0	0	2
	Total		4	39	4	1	48
3.00	After your first period but before your next period, did your physical activity patterns CHANGE?	I do not know/I cannot remember	1	0		0	1
		My physical activity patterns stayed the same	2	24		1	27
		My physical activity patterns increased	0	1		0	1
	Total		3	25		1	29
4.00	After your first period but before your next period, did your physical activity patterns CHANGE?	I do not know/I cannot remember	2	2			4
		My physical activity patterns stayed the same	4	29			33
	Total		6	31			37

Symmetric Measures

AGE_GROUP			Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
1.00	Measure of Agreement	Kappa	-.015	.099	-.117	.907
	N of Valid Cases		30			
2.00	Measure of Agreement	Kappa	.111	.125	1.163	.245
	N of Valid Cases		48			
3.00	Measure of Agreement	Kappa	.288	.246	2.347	.019
	N of Valid Cases		29			
4.00	Measure of Agreement	Kappa	.311	.212	1.941	.052
	N of Valid Cases		37			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

SDIE EFFECTS FROM BIRTH CONTROL **BY RESPONDENT CURRENT AGE**

Have you ever experienced any side effects from taking any form of birth control? * Have you ever experienced any side effects from taking any form of birth control? Crosstabulation

Count

AGE_GROUP			Have you ever experienced any side effects from taking any form of birth control?			
			No	Yes	I have never used any form of birth control	Total
1.00	Have you ever experienced any side effects from taking any form of birth control?	No	7	3	1	11
		Yes	1	9	0	10
		I have never used any form of birth control	0	0	9	9
	Total		8	12	10	30
2.00	Have you ever experienced any side effects from taking any form of birth control?	No	10	2	0	12
		Yes	1	32	0	33
		I have never used any form of birth control	0	0	3	3
	Total		11	34	3	48
3.00	Have you ever experienced any side effects from taking any form of birth control?	No	7	1	0	8
		Yes	0	17	0	17
		I have never used any form of birth control	1	0	3	4
	Total		8	18	3	29
4.00	Have you ever experienced any side effects from taking any form of birth control?	No	14	1	0	15
		Yes	2	16	0	18
		I have never used any form of birth control	0	0	4	4
	Total		16	17	4	37

Symmetric Measures

AGE_GROUP			Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
1.00	Measure of Agreement	Kappa	.751	.101	5.895	.000
	N of Valid Cases		30			
2.00	Measure of Agreement	Kappa	.862	.078	7.183	.000
	N of Valid Cases		48			
3.00	Measure of Agreement	Kappa	.874	.084	6.121	.000
	N of Valid Cases		29			
4.00	Measure of Agreement	Kappa	.862	.077	6.620	.000
	N of Valid Cases		37			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

APPENDIX F. OTHER ANALYSIS DESCRIPTIVES

AGE AT FIRST PERIOD BY SELF-IDENTIFIED ATHLETE TYPE

Statistics

How old were you the first time you had your period?

Non-Athlete	N	Valid	49
		Missing	0
Competitive Athlete	N	Valid	60
		Missing	0
Recreational Athlete	N	Valid	35
		Missing	0

FREQUENCY OF RESPONDENTS BY AGE AT MENARCHE

Statistics

TFP_ATHLETE_type

11 or younger	N	Valid	24
		Missing	0
12-15	N	Valid	110
		Missing	0
16 or older	N	Valid	10
		Missing	0

AVERAGE PHYSICAL ACTIVITY HOURS BY SELF-IDENTIFIED ATHLETE TYPE

Descriptive Statistics

TFP_ATHLETE_type		N	Minimum	Maximum	Mean	Std. Deviation
Non-Athlete	activity_hrs_4mo	49	.00	14.00	3.7857	2.95275
	Valid N (listwise)	49				
Competitive Athlete	activity_hrs_4mo	60	2.00	25.00	12.0500	5.25833
	Valid N (listwise)	60				
Recreational Athlete	activity_hrs_4mo	34	3.00	30.00	8.8382	6.29179
	Valid N (listwise)	34				

AVERAGE PHYSICAL ACTIVITY HOURS BY AGE AT MENARCHE

Descriptive Statistics

How old were you the first time you had your period?		N	Minimum	Maximum	Mean	Std. Deviation
11 or younger	activity_hrs_4mo	24	.00	20.00	6.6250	5.37152
	Valid N (listwise)	24				
12-15	activity_hrs_4mo	109	.00	30.00	8.7615	6.25041
	Valid N (listwise)	109				
16 or older	activity_hrs_4mo	10	.00	15.00	9.5000	4.94975
	Valid N (listwise)	10				

FREQENCY OF AGE AT MENARCHE BY SELF-IDENTIFIED ATHLETE TYPE

How old were you the first time you had your period?

TFP_ATHLETE_type			Frequency	Percent	Valid Percent	Cumulative Percent
Non-Athlete	Valid	11 or younger	10	20.4	20.4	20.4
		12-15	36	73.5	73.5	93.9
		16 or older	3	6.1	6.1	100.0
		Total	49	100.0	100.0	
Competitive Athlete	Valid	11 or younger	7	11.7	11.7	11.7
		12-15	47	78.3	78.3	90.0
		16 or older	6	10.0	10.0	100.0
		Total	60	100.0	100.0	
Recreational Athlete	Valid	11 or younger	7	20.0	20.0	20.0
		12-15	27	77.1	77.1	97.1
		16 or older	1	2.9	2.9	100.0
		Total	35	100.0	100.0	

COMPETITIVE ATHLETES' AVERAGE PHYSICAL ACTIVITY LEVEL 13-18

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
HS_COMP_HRS	78	.00	20.00	10.6410	3.54186
Valid N (listwise)	78				

COMPETITIVE ATHLETES' AVERAGE PHYSICAL ACTIVITY LEVEL 18-24

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
COLLEGE_COMP_HRS	48	3.00	25.00	14.5417	4.70382
Valid N (listwise)	48				

COMPETITIVE ATHLETES' AVERAGE PHYSICAL ACTIVITY LEVEL 25-40

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
PC_COMP_HRS	13	6.00	30.00	13.3846	6.52608
Valid N (listwise)	13				

COMPETITIVE ATHLETE PA LEVEL IN HIGH SCHOOL BY AVG ANNUAL PERIOD NUMBER

Descriptive Statistics

Between the ages of 13 and 18, approximately how many periods did you have per year, on average?		N	Minimum	Maximum	Mean	Std. Deviation
I do not know/I cannot remember	HS_COMP_HRS	2	12.00	12.00	12.0000	.00000
	Valid N (listwise)	2				
0-3	HS_COMP_HRS	6	8.00	15.00	12.0000	2.44949
	Valid N (listwise)	6				
4-6	HS_COMP_HRS	6	8.00	12.00	11.1667	1.60208
	Valid N (listwise)	6				
7-9	HS_COMP_HRS	13	6.00	15.00	11.2308	2.77350
	Valid N (listwise)	13				
10-12	HS_COMP_HRS	46	.00	20.00	10.4130	4.06927
	Valid N (listwise)	46				
13 or more	HS_COMP_HRS	4	3.00	10.00	8.2500	3.50000
	Valid N (listwise)	4				
Other	HS_COMP_HRS	1	9.00	9.00	9.0000	.
	Valid N (listwise)	1				

COMPETITIVE ATHLETE PA LEVEL IN COLLEGE BY AVG ANNUAL PERIOD NUMBER

Descriptive Statistics[a]

Between the ages of 18 and 24, approximately how many periods did you have per year, on average?		N	Minimum	Maximum	Mean	Std. Deviation
0-3	COLLEGE_COMP_HRS	7	13.00	23.00	16.7143	3.35233
	Valid N (listwise)	7				
4-6	COLLEGE_COMP_HRS	4	11.00	25.00	17.0000	6.05530
	Valid N (listwise)	4				
7-9	COLLEGE_COMP_HRS	6	14.00	19.00	17.3333	1.96638
	Valid N (listwise)	6				
10-12	COLLEGE_COMP_HRS	31	3.00	20.00	13.1935	4.77088
	Valid N (listwise)	31				

a. No statistics are computed for one or more split files because there are no valid cases.

COMPETITIVE ATHLETE PA LEVEL POST-COLLEGE BY AVG ANNUAL PERIOD NUMBER

Descriptive Statistics[a]

Between the ages of 25 and 40, approximately how many periods did you have per year, on average?		N	Minimum	Maximum	Mean	Std. Deviation
0-3	PC_COMP_HRS	3	8.00	30.00	18.0000	11.13553
	Valid N (listwise)	3				
4-6	PC_COMP_HRS	2	8.00	14.00	11.0000	4.24264
	Valid N (listwise)	2				
7-9	PC_COMP_HRS	1	17.00	17.00	17.0000	.
	Valid N (listwise)	1				
10-12	PC_COMP_HRS	6	6.00	20.00	11.8333	5.11534
	Valid N (listwise)	6				
13 or more	PC_COMP_HRS	1	10.00	10.00	10.0000	.
	Valid N (listwise)	1				

a. No statistics are computed for one or more split files because there are no valid cases.